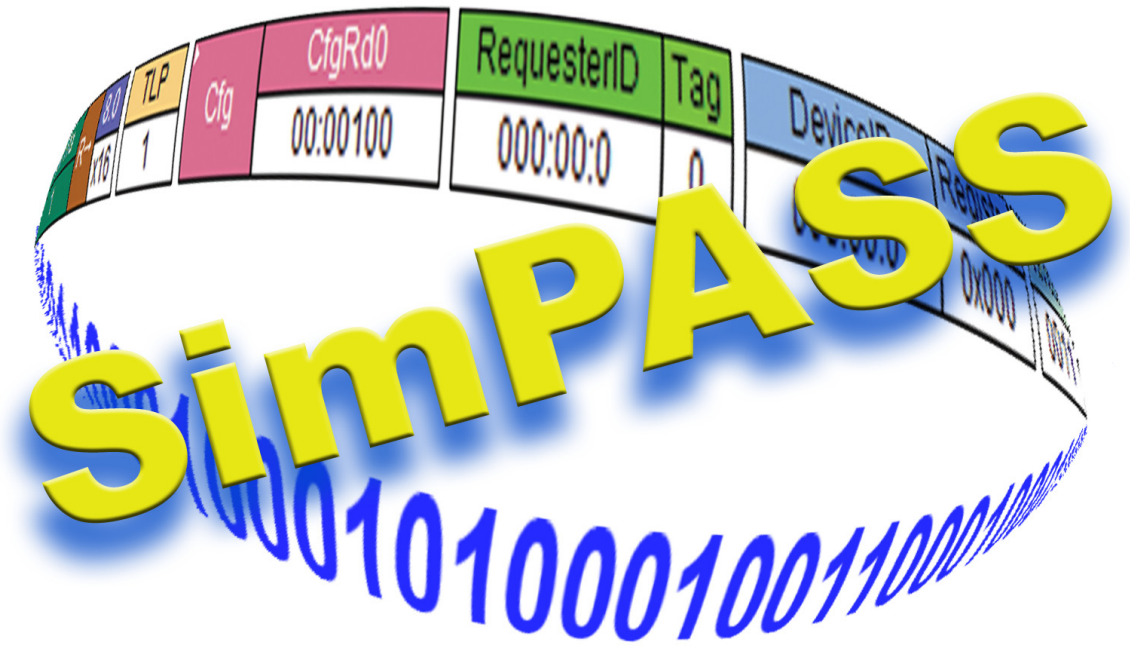
TELEDYNE LECROY
Everywhereyoulook™

Teledyne LeCroy SimPass PE™
PCI Express Analysis Software
User Manual



For SimPass PE Software Version 1.1x

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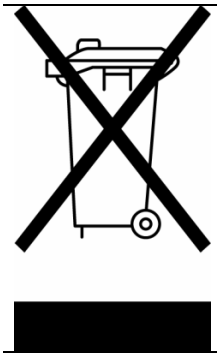

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Chapter 1: Overview

The Teledyne LeCroy SimPASS PE™ PCI Express Protocol Analyzer Software is a powerful and intuitive expert software system embedding detailed knowledge of the protocol hierarchy and intricacies, as defined in the protocol specification. It allows you to import your simulation results and analyze them in a graphical display that has been optimized for fast and easy navigation through a simulated traffic session. Users are alerted as violations are detected at all levels of the protocol layering and can easily drill down on areas of interest or collapse and hide fields that are not relevant. It is based on Teledyne LeCroy PCIe Protocol Suite™ PCI Express Analysis Software running in the Windows operating system.

Features and Benefits

The Teledyne LeCroy PCI Express Protocol Analyzer Software has the following features and benefits:

Features	Benefits
Powerful and Intuitive CATC Trace™ Analysis Software	Faster interpretation and debug of PCI Express traffic with color-coded, clearly labeled protocol elements in a graphical display. Reduces coding and deciphering.
Extensive Decoding	Complete, accurate and reliable decoding of TLPs (Transaction Layer Packets), DLLPs (Data Link Layer Packets),and all PCI Express Primitives.
Intelligent Reporting	Quickly identify and track error rates and abnormal link or timing conditions. Display configuration space and protocol specification details.
Sophisticated Viewing	View Packet, Link, and Split transaction levels of the PCI Express protocol. Collapsible/expandable headers with Tool tip explanations make it easy to navigate and interpret packet contents, headers, and commands. View packets, transactions of TLPs and DLLPs in classic CATC Trace™ format or in raw bit stream for deeper analysis.
Dword to Transaction Level Viewer	View Dwords, Packet, Link and Split Transaction levels of the PCI Express protocol.

1.1 Other Documents

For more information, refer to the following documents:

- *Teledyne LeCroy Analyzers File-based Decoding Manual*
- *PCIe Protocol Suite VSE Manual*

Chapter 2: Installation

The SimPASS PE™ software is installed on a Linux®-based PC running in a Windows® emulation environment that is installed together with SimPASS PE software.

Please consult the **readme** file on the installation DVD for the latest PC requirements.

To install the SimPASS PE software on the Host PC:

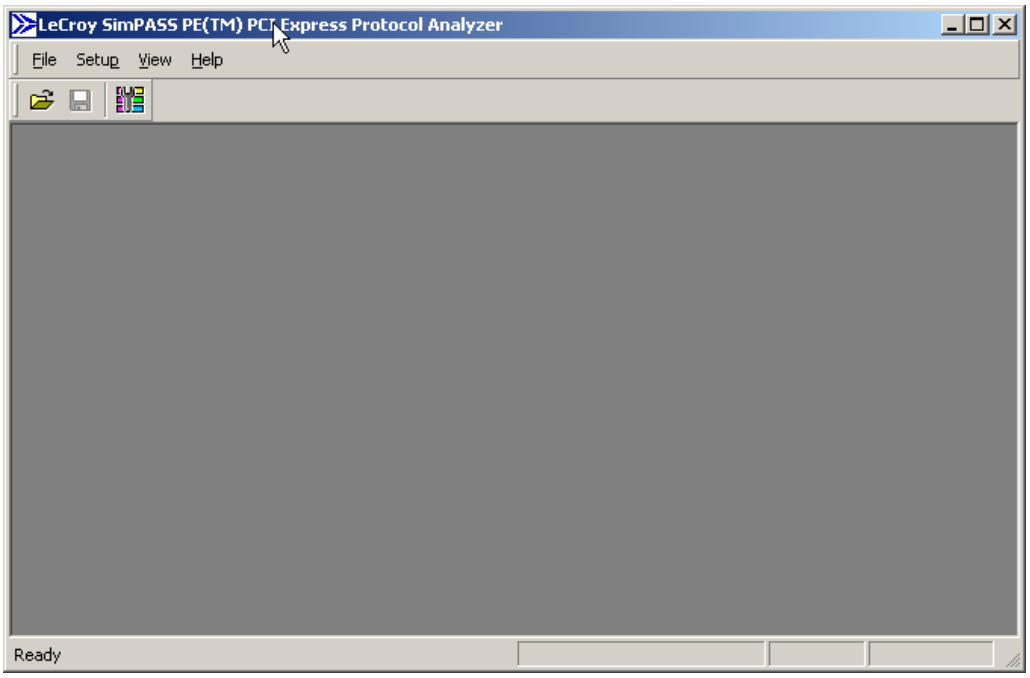
Step 1 Insert the DVD into the DVD-ROM drive of the PC.

Alternatively, you can download the SimPASS PE installation from the Teledyne LeCroy web site.

Step 2 The SimPASS PE software installs automatically on the PC hard disk. Follow the onscreen instructions.

Starting the Application

Launch the SimPASS PE program to open the SimPASS PE main window.



Chapter 3: Licensing

3.1 Installing a License File

To import **.simpass** files requires an appropriate license.

After obtaining a SimPASS PE License file, install it using the following procedure.

Step 1 Run the SimPASS PE application.

Step 2 Select **Help > Install Software License File**.

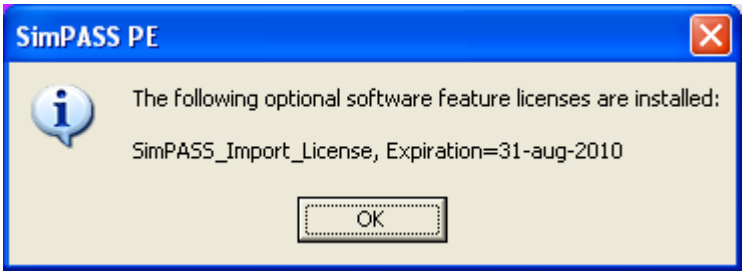
Step 3 Use the Open dialog box file browser to locate and select the license file. If the license is valid, it will install itself. Otherwise, contact PSG support. See “How to Contact Teledyne LeCroy” on page 110 to purchase a valid license.

Note: You do not need a license to view recorded or imported trace files in SimPASS PE.

3.2 Checking License Information

To view the SimPASS PE license registered with an instance of the SimPASS PE application, open the application and select **Help > Display License Information** to display a message.

The message shows the installed licenses and their respective expiration dates.

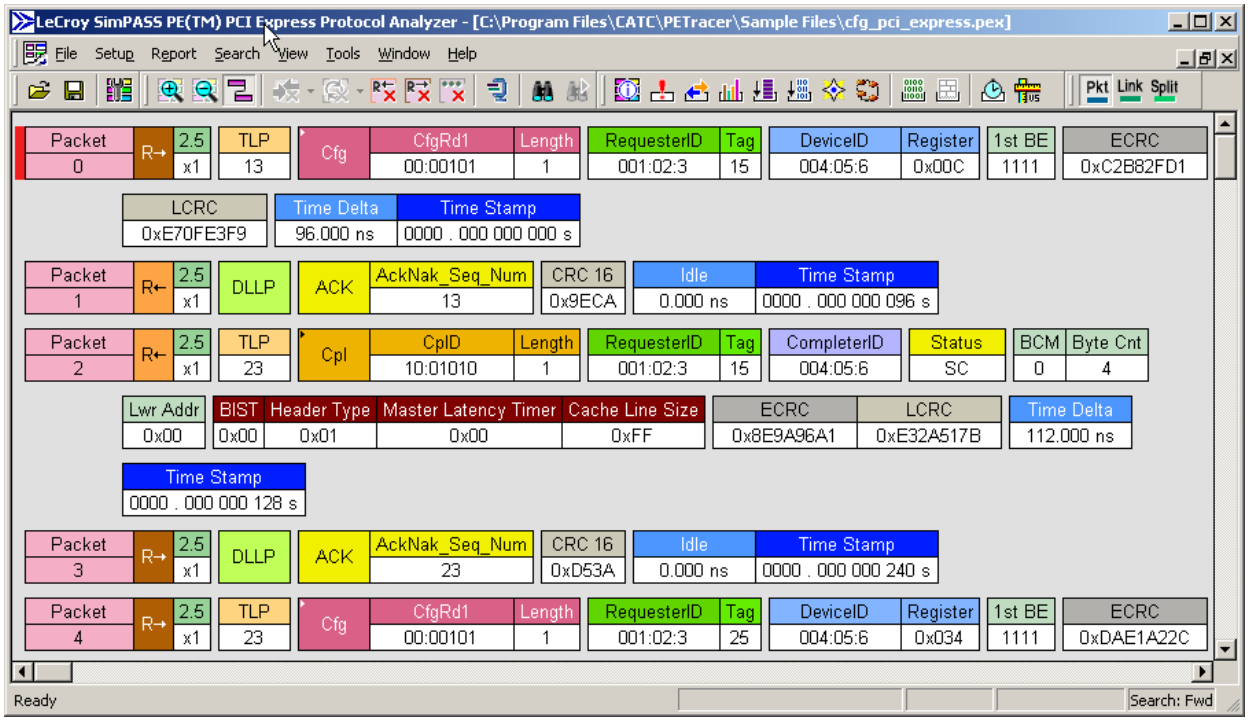


Chapter 4: Software Overview

4.1 The SimPASS PE Software

The SimPASS PE™ software administers Analyzer platforms and handles all CATC Trace analysis and display.

The software runs in a Windows®-emulation environment on a Linux-based PC. It allows you to import simulation results for analysis.


LeCroy SimPASS PE(TM) PCI Express Protocol Analyzer - [C:\Program Files\CATC\PETracer\Sample Files\cfg_pci_express.pex]
File Setup Report Search View Tools Window Help
Pkt Link Split
Packet 0 | R→ | 2.5 x1 | TLP 13 | Cfg | CfgRd1 00:00101 | Length 1 | RequesterID 001:02:3 | Tag 15 | DeviceID 004:05:6 | Register 0x00C | 1st BE 1111 | ECRC 0xC2B82FD1
LCRC 0xE70FE3F9 | Time Delta 96.000 ns | Time Stamp 0000 . 000 000 000 s
Packet 1 | R← | 2.5 x1 | DLLP | ACK | AckNak_Seq_Num 13 | CRC 16 0x9ECA | Idle 0.000 ns | Time Stamp 0000 . 000 000 096 s
Packet 2 | R← | 2.5 x1 | TLP 23 | Cpl | CplD 10:01010 | Length 1 | RequesterID 001:02:3 | Tag 15 | CompleterID 004:05:6 | Status SC | BCM 0 | Byte Cnt 4
Lwr Addr 0x00 | BIST 0x00 | Header Type 0x01 | Master Latency Timer 0x00 | Cache Line Size 0xFF | ECRC 0x8E9A96A1 | LCRC 0xE32A517B | Time Delta 112.000 ns
Time Stamp 0000 . 000 000 128 s
Packet 3 | R→ | 2.5 x1 | DLLP | ACK | AckNak_Seq_Num 23 | CRC 16 0xD53A | Idle 0.000 ns | Time Stamp 0000 . 000 000 240 s
Packet 4 | R→ | 2.5 x1 | TLP 23 | Cfg | CfgRd1 00:00101 | Length 1 | RequesterID 001:02:3 | Tag 25 | DeviceID 004:05:6 | Register 0x034 | 1st BE 1111 | ECRC 0xDAE1A22C
Ready
Search: Fwd

4.2 Application Layout

The SimPASS PE application contains the following components:

Title bar: The title bar is at the top of the application window and displays the CATC Trace file name or generation script name.

Menu bar: The menu bar is located below the title bar, by default. The menu bar can be moved by clicking a blank area of the bar and then dragging the menu to a new position. It can be docked in another part of the application window or moved outside of the window to become a floating menu.

Toolbar: The toolbar is composed of buttons that represent the commonly used commands. The toolbar divides into smaller toolbars that can be moved and docked in a new position or made to float outside of the window.

Display area: The display area is the main part of the application window in which traces are displayed.

Status bar: The status bar is located at the bottom of the application window. The left end of the status bar displays descriptions of buttons and menu items when the mouse is positioned over them. The right end of the bar shows the search direction.

4.3 Using the Toolbar

You can use the SimPASS PE application Toolbar as a shortcut to most of the operations supplied by the menus.

Opens a previously recorded, or imported, CATC Trace file.

Save As
Allows the open file to be saved with a new name.

Setup Display Options
Opens the Display Options dialog box.

Zoom in display.

Wraps display information.

Zoom out display.

Hide Training Sequence.

Hide Downstream traffic/recording.

Hide SKIP and Update FC packets.

Advanced Hiding Options
Opens a dialog box that allows you to select items to hide from view.

Hide Upstream recording/traffic.

Compact View
Toggles compacting of training sequences to analyze CATC Trace data faster, or no compacting to display more data.

Find
Opens a dialog box that allows you to select one or more items to find in the recording, then searches to that point.

Find Next. Repeats last Find or Search action.

View Packet Level data.

View Link Transaction Level data.

View Split Transaction Level data

File Information
Lists the conditions under which the recording was made.

Bus Utilization
Opens a window that graphically represents various information about the recording.

Error Report
Opens a window that lists all errors identified in the recording.

Link Tracker
Opens a window that displays symbol information per lane.

Traffic Summary
Opens a window that lists all events that occurred during the recording

Opens the Data Flow window.
Shows recorded data in a compressed tabular format.

Navigator. Shows/hides the Navigator bar - a utility that lets you easily navigate the CATC Trace.

LTSSM Flow Graph
Shows a state diagram of the Link Training and Status State machine.

Displays the Data/Payload window for the current packet.

Displays the Packet Header bar.
Opens a window that displays the header information in the current packet, as it would be viewed in the specification.

Opens the Timing and Bus Usage Calculations window.

Running Verification Scripts
Opens a dialog that allows you to select and run verification scripts.

Multi-Segment Toolbar

First Segment. Open first segment in the multisegment CATC Trace.

Index file. This button becomes active if a multisegment CATC Trace file is open and displays the index file for the recording.

Previous segment. Open previous segment in the multisegment CATC Trace.

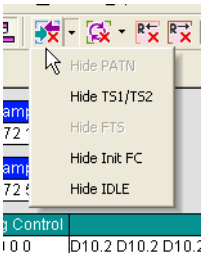
Next Segment. Open next segment in multisegment CATC Trace.

Last segment. Open last segment in multisegment CATC Trace.

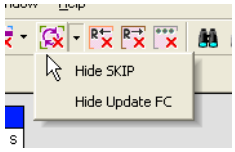
Toolbar Hide Buttons

The SimPASS PE application toolbar has five buttons related to show/hide of CATC Trace file contents. The buttons allow you to quickly adjust the display to your needs.

Hide Training: Brings up a drop-down menu that lets you to hide all or a portion of the packets in the training portion of the CATC Trace.



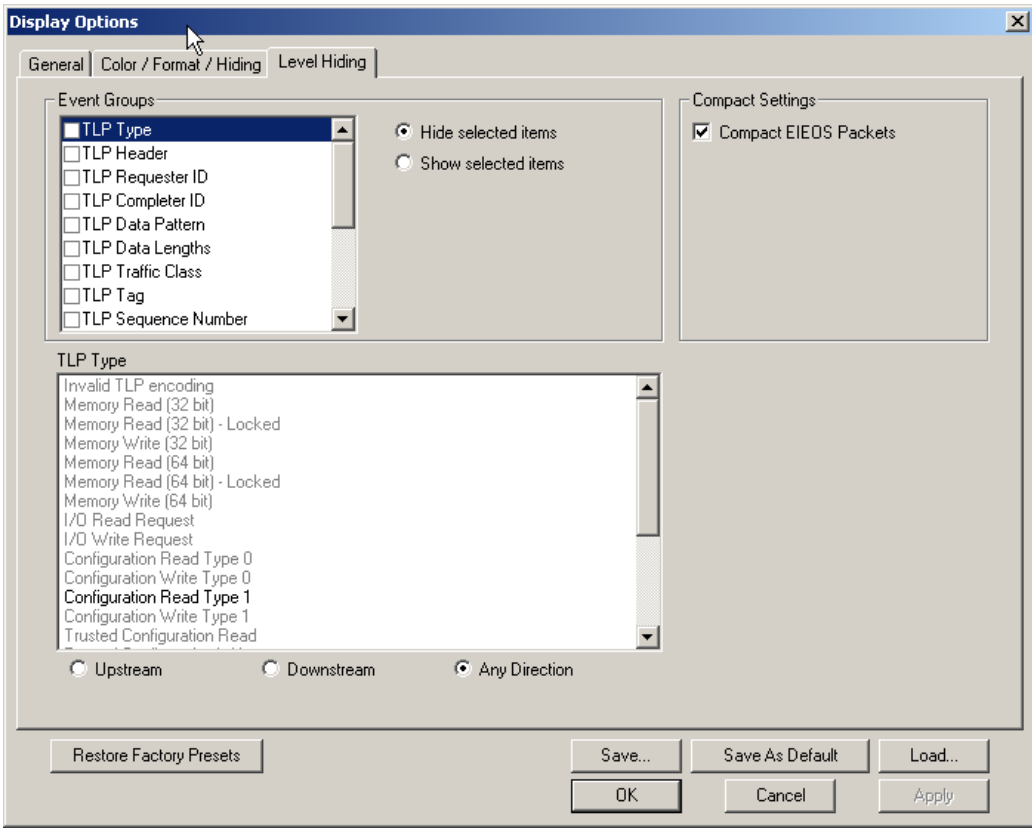
Hide SKIP and Update FC: Brings up a drop-down menu that lets you hide SKIP or Update FC packets in a CATC Trace.



Hide Upstream: Hide all traffic from endpoint devices to the root complex.

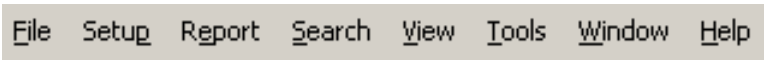
Hide Downstream: Hide all traffic from the root complex to endpoint devices.

Advanced Hiding Options: Brings up the Level Hiding pane of the Display Options window. Use this pane to tune the show/hide options within the CATC Trace display.



4.4 Using the Menus

The SimPASS PE application main display includes the following set of pull-down menus:



File Menu

New Generator Script	Creates a new Traffic Generation file.
Open	Opens a file.
Close	Closes the current file.
Save as	Saves all or a specified range of packets to a uniquely named file.
Convert Old Files	Convert CATC Trace files.
Print	Prints part or all of the current traffic data file.
Print Preview	Produces an on-screen preview before printing.
Print Setup	Setup your current or new printer.
Import SimPASS File to Protocol Trace	Imports a .**simpass** file as a CATC Trace file. CATC Trace files are optimized for protocol analysis.
Import SimPASS File to Bit Trace	Imports a .**simpass** file as a BitTracer file. BitTracer files are optimized for link and phy layer analysis.
Edit Comment	Create or edit the comment field in a CATC Trace file.
Export >> to Text >> Packets to CSV Text >> to Generator File Format	Saves all or part of a CATC Trace to a text file or traffic generation file. This text file summarizes the traffic in the CATC Trace. Saves the CATC Trace to a text file in Comma Separated Value (CSV) format. Saves the CATC Trace to a generation file.
Exit	Exit the SimPASS PE application.

Setup Menu

Display Options	Allows you to customize display options such as field colors, field formats and level hiding.

Report Menu

Report Menu operations are only available when you are working with a CATC Trace file.

File Information	Displays information about the file contents and describes the conditions of the file's recording (Recording Options, hardware information, and so on).
Error Summary	Displays an error summary of the current CATC Trace file and allows you to go to a specific packet, and save the error file to a uniquely named file.
Traffic Summary	Details the number and types of packets that were transferred during the recording. You can hide, save, send, text, print, and view.
Bus Utilization	Opens a window with graphs of bus usage for the open CATC Trace.
Link Tracker	Opens a window for displaying a detailed chronological view of traffic. The window provides view and navigation options.
Data Flow	Opens the Data Flow Window, providing a tabular view of transactions and their payload.
Trace Navigator	Shows the Navigator bar for navigating a CATC Trace. Shows a snapshot of the recording and allows you to adjust the memory area for the view.
LTSSM Flow Graph	Shows a state diagram of bus activity. Also allows you to navigate through the LTSSM, based on the current recording.
Packet Header	Opens the Packet Header bar, showing the Packet Header information as it would be viewed in the specification.
Packet Data/View Data	Opens the Data Window for the current packet, with the options: Hide, Save, Hexadecimal, ASCII, Decimal, Binary, MSB Format, LSB Format, Big Endian, and Little Endian. Format Line allows you to enter the number of bytes, words, or dwords per line.
Configuration Space	Presents a list of Configuration Spaces. Clicking an item displays the selected Configuration Space in a Configuration Table format.

Search Menu

Search Menu operations are only available when you are working with a CATC Trace file.

Go to Trigger	Repositions the display to show the first packet following the trigger event.
Go to Segment/ Packet	Repositions the display to a specific packet, Link or Split transaction number.
Go to Time	Repositions the display to specific timestamp.
Go to Marker	Repositions the display to a previously marked packet, Link Transaction, or Split Transaction.
Go to Packet	Allows searching for specific link events: TLP Type, DLLP Type, Ordered Set, Link Event, Traffic Class, DLLP Virtual Channel, TLP Virtual Channel, Direction, Speed, Link Width, Requester ID, Completer ID, Data Lengths, Errors.
Find	Displays the Find dialog to allow searching for various events within a CATC Trace. You can search by Display Level: Packets, Link Transactions, Split Transactions. You can search packets by Event Group: TLP Type, TLP Header, TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors. You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. Find allows you to create complex searches based on numerous criteria. You can search by Display Level: Packets, Link Transactions, Split Transactions. You can search packets by Event Group: TLP Type, TLP Header, TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors. You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag. Find allows you to create complex searches based on numerous criteria.
Find Next	Repeats the previous Find or Search operation.
Search Direction	Allows you to specify a forward or backward search of a CATC Trace file.

View Menu

Toolbars>>	Displays available toolbars: Standard, Frequently Used, Analysis, and Transaction Level. Use Customize to display the Windows Customize window.
Script Editor	Displays the Script Editor (only appears if a **.peg** file is open).
Status Bar	Switches display of the Status Bar on or off.
Zoom In	Zoom in increases the size of the displayed elements.
Zoom Out	Zoom out decreases the size of the displayed elements.
Wrap	Allows the display to wrap.
FC Credits	Toggles a display for tracking Flow Control Credit update and consumption on a PCI Express link.
FC Credits Setup	Allows you to customize the display for tracking Flow Control Credits.
Compact View	Toggles compacting of the Link Training sequence to analyze CATC Trace data faster or no compacting to display more data.
Packet Level	View the current recording at the Packet Level.
Link Transaction Level	View the current recording at the Link Transaction Level.
Split Transaction Level	View the current recording at the Split Transaction Level.

Tools Menu

TC to VC Mapping	Allows Traffic Classes to be mapped to Virtual Channels for purposes of simplifying navigation (for example, Search > Go to > TLP Virtual Channel) and changing the way the CATC Trace is displayed (for example, in Split Transactions).
Timing Calculations	Starts the mode-less calculator dialog for calculating various timing and bandwidth parameters in the recording file.
Run Verification Scripts	Presents a list of verification scripts, from which you can run a verification script.

Window Menu

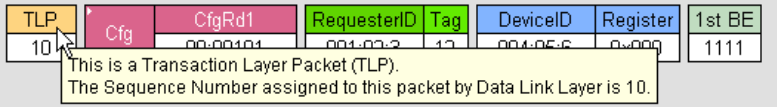
New Window	Opens a copy of the current CATC Trace window.
Cascade	Displays all open CATC Trace windows in an overlapping arrangement.
Tile	Displays all open CATC Trace windows as a series of strips across the display.
Arrange Icons	Arranges minimized CATC Trace windows at the bottom of the display.
Synchronize Traces	Synchronizes the CATC Trace View windows so that a move in one window repositions the other window of the same recording.

Help Menu

User Manuals	Accesses the SimPASS PE application user manuals.
Display License Information	Displays the installed licenses and their respective expiration dates.
Install Software License FIle	Installs a valid license file.
Register Product Online	Register at the Teledyne LeCroy website registration page.
About	Displays version information about the currently running SimPASS PE software.

4.5 Tool Tips

Tool tips provide details about fields within the CATC Trace. To see a tool tip, position your mouse pointer over a field within the CATC Trace.



You can turn off this capability in the Display Options menu.

4.6 Keyboard Shortcuts

Keystrokes	Operation
Ctrl + O	Open file
Ctrl + P	Print
Ctrl + S	Save file
Ctrl + Home	Jump to first packet
Ctrl + End	Jump to last packet
Ctrl + G	Go to packet ...
Ctrl + F	Search forward
F3	Find next
F6	Next pane
Shift + F6	Previous pane
Ctrl + B	Search backward

4.7 Search Direction Indicator

A segment in the status bar indicates search direction. The direction can be changed by selecting Search Direction from the Search menu.

4.8 Importing a SimPASS PE File

The SimPASS PE software creates and uses two related file types:

- **Teledyne LeCroy CATC PCI Express Protocol Analysis File (CATC Trace file)**: Trace files optimized for protocol analysis
- **Teledyne LeCroy PCI Express BitTracer Analyzer File (BitTracer file)**: Trace files optimized for link and phy layer analysis

SimPASS PE import files have the extension "**.simpass**". Simulation environments of participating vendors create these files to allow importing the logical PCI Express simulation traffic into a CATC Trace file and into a BitTracer file.

To import a **.simpass** file to a CATC Trace file:

Step 1 Select **File > Import SimPASS File to Protocol Trace**...

Step 2 Select a **.simpass** file.

To import a **.simpass** file to a BitTracer file:

Step 1 Select **File > Import SimPASS File to BitTrace**...

Step 2 Select a **.simpass** file.

4.9 Opening CATC Trace Files

To open an existing CATC Trace file, click **File > Open** or .

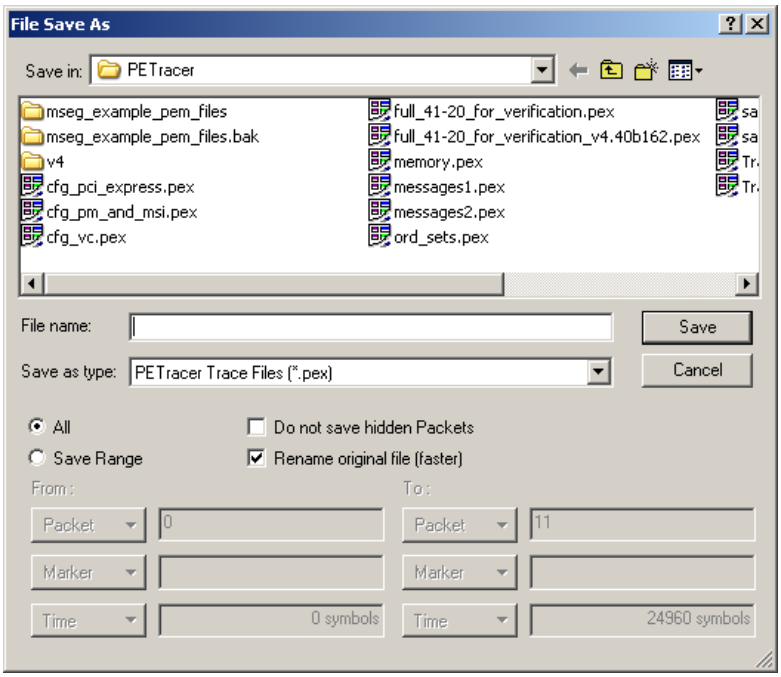
4.10 Saving CATC Trace Files

Using the Save As Function

When you record a CATC Trace file, the Analyzer software provides a pre-defined name to the CATC Trace file (**data.pex** or any other that you specified in the Recording Options). If you do consecutive recordings, each time the previous recording is overwritten. If you see a recording you want to analyze later, you need to give a unique name to the CATC Trace file, so it is not overwritten with the next recording.

Also, when you analyze a recorded CATC Trace file, you might be interested in preserving just a part of the PCI Express traffic that was recorded. If you save a portion of a CATC Trace file, it can get significantly smaller, allowing you to attach it to an e-mail.

To save a portion of a CATC Trace file or the whole file to a unique name, select **Save As** from the File menu.



If you want to give a unique name to the CATC Trace file, select the **All** option and keep **Rename original file** checked. This is the default setting for the dialog.

Saving a Portion of a CATC Trace

If you want to save a portion of a CATC Trace file, select **Save packet range**. Enter starting and ending packet numbers in the **From Packet** and **To Packet** fields. By default, it has the numbers of the first and the last packets in the file. The software is going to save all the packets in specified range to the new file, unless you have **Do not save hidden packets** checked. In this case it is going to save all packets in the range, EXCLUDING the currently hidden packets.

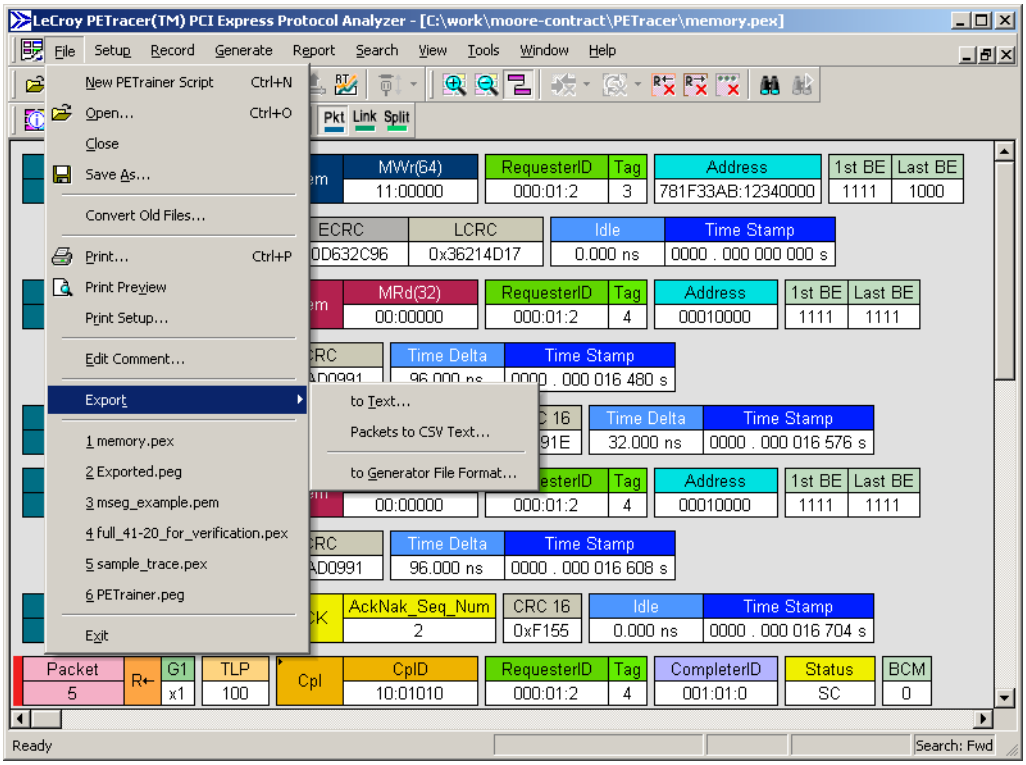
4.11 Exporting a CATC Trace File

By default, SimPASS PE saves CATC Trace files in the **.pex** format. However, you can export a CATC Trace to a file in any of the following other formats:

- Text
- Comma Separated Value (CSV)
- Generator file format

Exporting to Generator file format is a simple way to create a script file from your CATC Trace.

To export a CATC Trace file, select **File > Export**:


LeCroy PETracer(TM) PCI Express Protocol Analyzer - [C:\work\moore-contract\PETracer\memory.pex]
File Setup Record Generate Report Search View Tools Window Help
New PETrainer Script Ctrl+N
Open... Ctrl+O
Close
Save As...
Convert Old Files...
Print... Ctrl+P
Print Preview
Print Setup...
Edit Comment...
Export
1 memory.pex
2 Exported.peg
3 mseg_example.pem
4 full_41-20_for_verification.pex
5 sample_trace.pex
6 PETrainer.peg
Exit
to Text...
Packets to CSV Text...
to Generator File Format...
Pkt Link Split
MWr(64) RequesterID Tag Address 1st BE Last BE
11:00000 000:01:2 3 781F33AB:12340000 1111 1000
ECRC LCRC Idle Time Stamp
0D632C96 0x36214D17 0.000 ns 0000 . 000 000 000 s
MRd(32) RequesterID Tag Address 1st BE Last BE
00:00000 000:01:2 4 00010000 1111 1111
Time Delta Time Stamp
0000 . 000 016 480 s
Time Delta Time Stamp
32.000 ns 0000 . 000 016 576 s
00:00000 000:01:2 4 00010000 1111 1111
Time Delta Time Stamp
96.000 ns 0000 . 000 016 608 s
AckNak_Seq_Num CRC 16 Idle Time Stamp
2 0xF155 0.000 ns 0000 . 000 016 704 s
Packet R G1 TLP Cpl CplD RequesterID Tag CompleterID Status BCM
5 x1 100 10:01010 000:01:2 4 001:01:0 SC 0
Ready
Search: Fwd

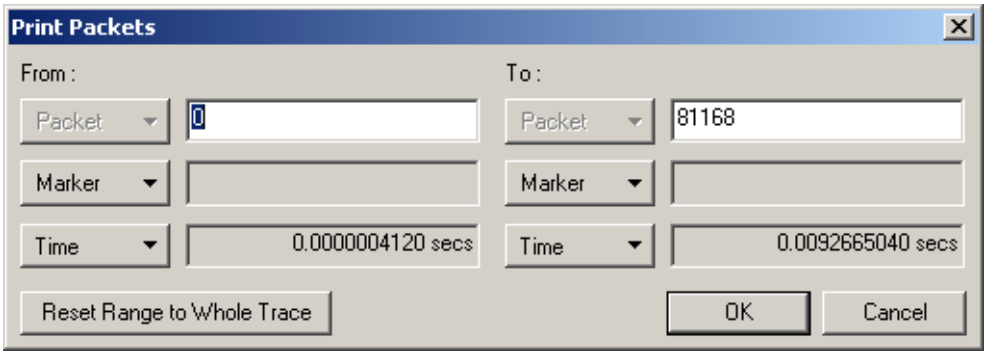
4.12 Printing Data Files

To print all or part of the open CATC Trace:

Step 1 Select **File > Print** from the menu or

click the **Printer** button on the toolbar.

The Print Packets dialog opens:



Step 2 To select a range of packets, enter values in the **From packet #** and **To packet #** fields and click **Print**.

Step 3 To print an entire file, leave the From and To fields empty and click **Print**.

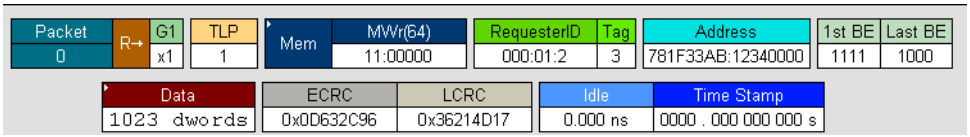
The specified traffic information is printed as currently displayed, in color or gray scale as supported by your printer. Any CATC Trace File comments you entered are printed following the current document name at the top of each page.

Note: CATC Trace File comments can be created by using **Edit Comment** on the File menu.

Chapter 5: Reading CATC Traces

5.1 Viewing PCI Express CATC Traces

SimPASS PE™ displays traffic as labeled, color-coded, and time-stamped rows.



Tool tips provide details about fields within the CATC Trace. Hold the mouse cursor over a field to see a tool tip.

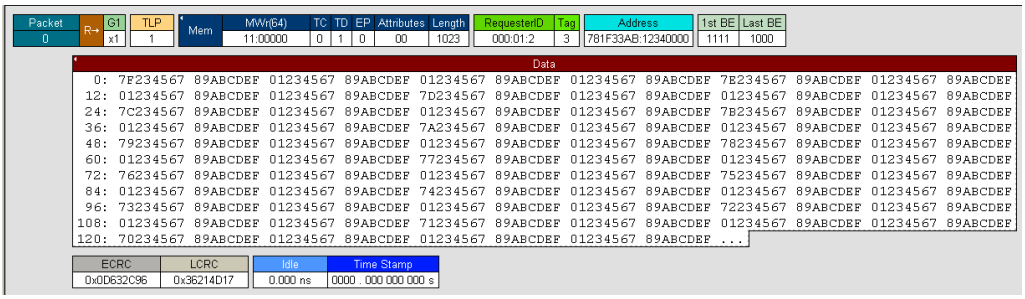
Additional information is available from pop-up menus. For example, if you click the left mouse button on the first cell in a packet a menu appears with an option to view Raw 10b Codes.

5.2 Expand and Collapse Data Fields

Packet data fields are displayed in a short format by default.

You can view a data field's long format by performing one of the following three actions:

- Click the **small triangle** in the left corner.
- Double-click anywhere in the data field.
- Click once in the Data Field with the left mouse button, then choose **Expand Data** from the pop-up menu.



A repeat of any above methods causes the display to return to a Short Data format.

5.3 Resizing Cells

Data cells can be resized by pointing the mouse pointer on the edge of a data cell, depressing and holding the left mouse button, and then repositioning the mouse pointer while keeping the mouse button depressed.

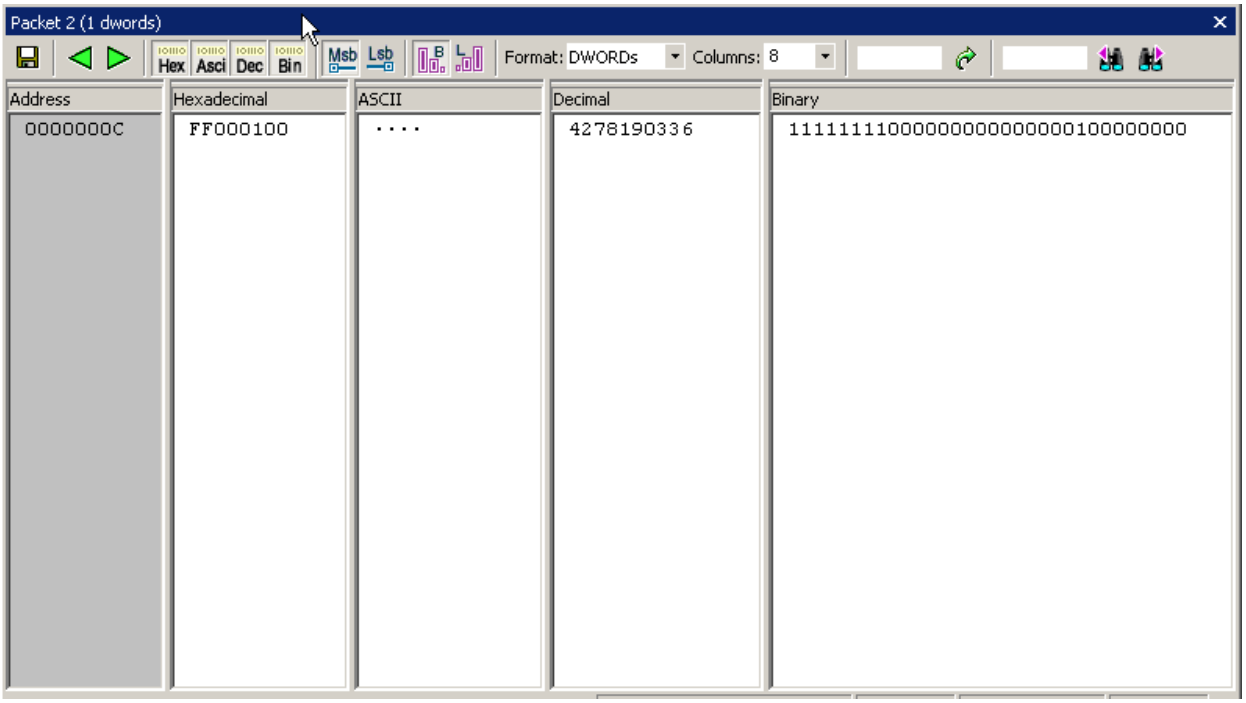
5.4 Pop-up Menus

The Analyzer software makes extensive use of pop-up menus. In some instances, pop-up menus provide the only means of accessing dialog boxes that contain detailed information about cells within the CATC Trace, for example, the Show Configuration Space dialog box.

To see a pop-up menu, left-click or right-click a **cell** within the CATC Trace. Right-click or left-click behavior depends on the Display Options setting. For default left-click, the right-click menu is not cell-dependent. For other left-click behavior, the type of menu that opens varies depending on the type of cell that is selected. Take some time to explore CATC Traces and the various pop-up menus.

5.5 View Data Block

To view the raw bits that make up the data in a data field, left-click a data field, then click or select **View Data Block** from the pop-up menu to display the Data Block window.



You can display data in Hexadecimal, ASCII, Decimal, or Binary formats.

Bit Order is Most Significant Bit or Least Significant Bit.

You can display data in Big Endian or Little Endian.

Format lets you display data as BYTEs, WORDs, or DWORDs.

Columns lets you select the number of columns.

You can enter hexadecimal offset values.

You can go to or search Previous or Next.

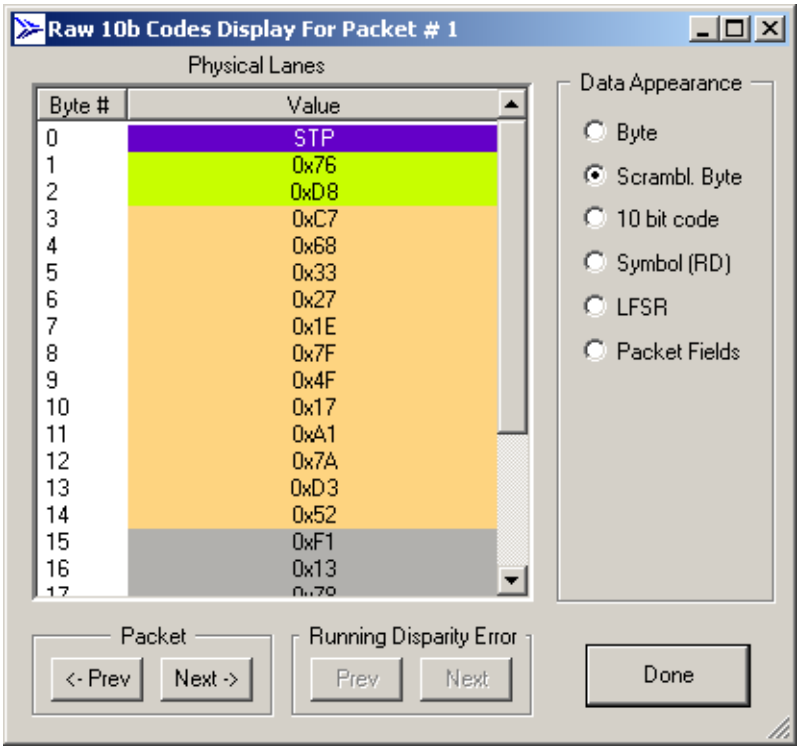
5.6 Show Raw 10b Codes

You can view the raw bits that make up the data field by left-clicking the field and selecting **View Data Block** from the pop-up menu.

To view Raw 10b Codes:

Step 1 Left-click the **first cell** in a packet.

Step 2 Select **Show Raw 10b Codes** from the pop-up menu to display the Raw 10b Codes window.



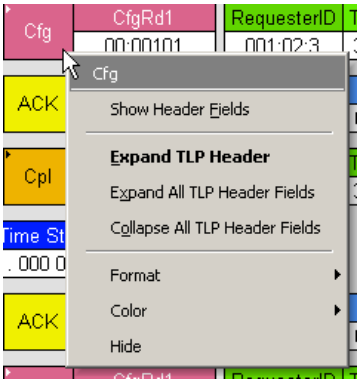
Step 3 To change the format of the data, use the options along the right side of the dialog.

Step 4 To navigate the CATC Trace, use the **Prev** and **Next** buttons.

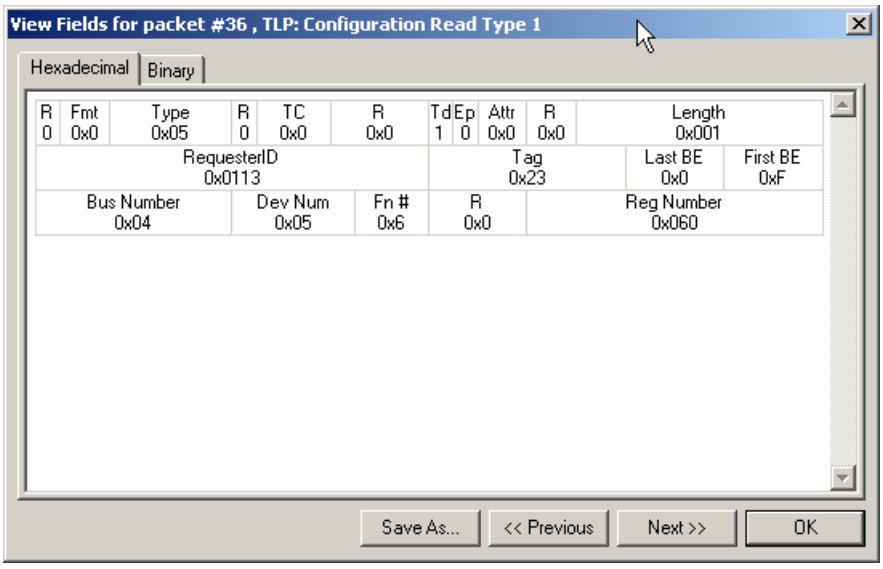
5.7 Show Header Fields

You can view details about header fields by opening the Show Header Fields dialog box.

Step 1 Click a **header.** A pop-up menu appears.



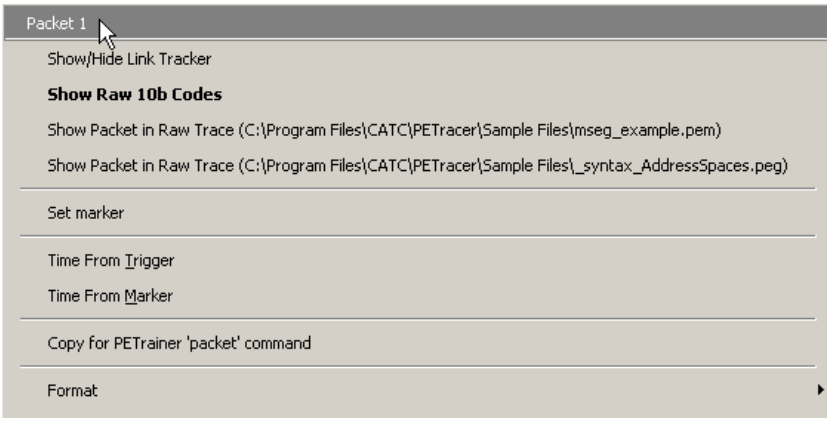
Step 2 Select **Show Header Fields**. The following dialog box opens.



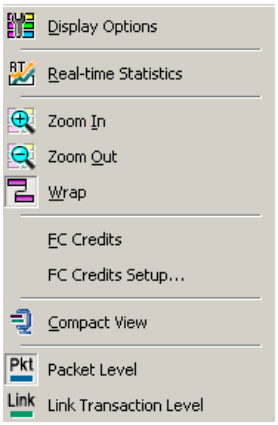
Step 3 Use the **Prev** and **Next** buttons to navigate to other headers.

5.8 Packet Cell Popup Menus

The Packet cell has a left-click pop-up menu that includes the Show Raw 10b Codes command:

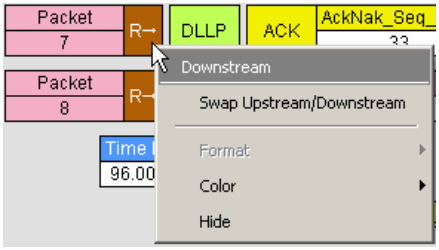


The right-click pop-up menu from Packet cell is:



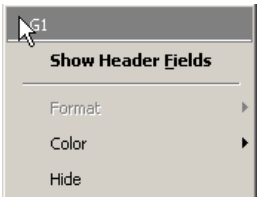
Packet Header R-> Cell Popup Menu

The Packet Header R-> cell has a pop-up menu with the Swap Upstream/Downstream command, which changes the directionality of the packets in the CATC Trace.



Packet Header G1 Cell Popup Menu

The Packet Header G1 cell has a pop-up menu with the Show Header Fields command (see “Show Header Fields” on page 23), which exposes a detailed view of the selected Header field.

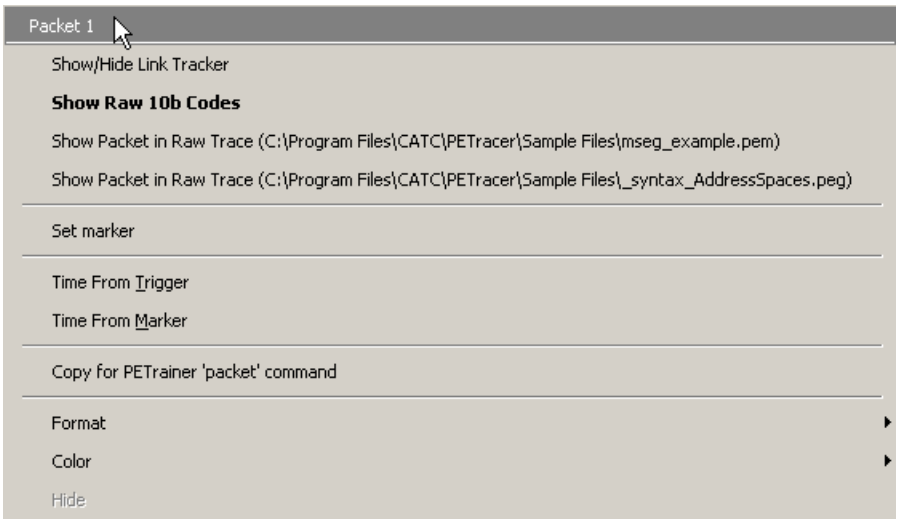


5.9 Set Marker

A marker is a unique label for a packet that allows you to go to that packet and also serves as a **comment string** for a specific packet. When you select a marker, the identified packet appears at the top of the screen. Packets that have been **marked** have a red bar on the left edge.

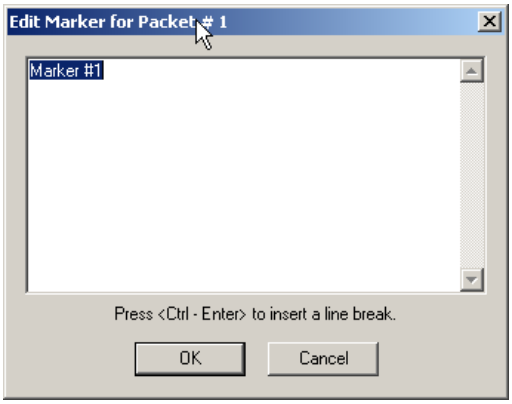
To set a marker, perform the following steps:

Step 1 Left-click the **Packet** field of the packet you want to mark.



Step 2 Click **Set Marker**.

Step 3 When the Edit Marker for Packet # pop-up appears, enter a unique identifier for the packet in the Comment field.

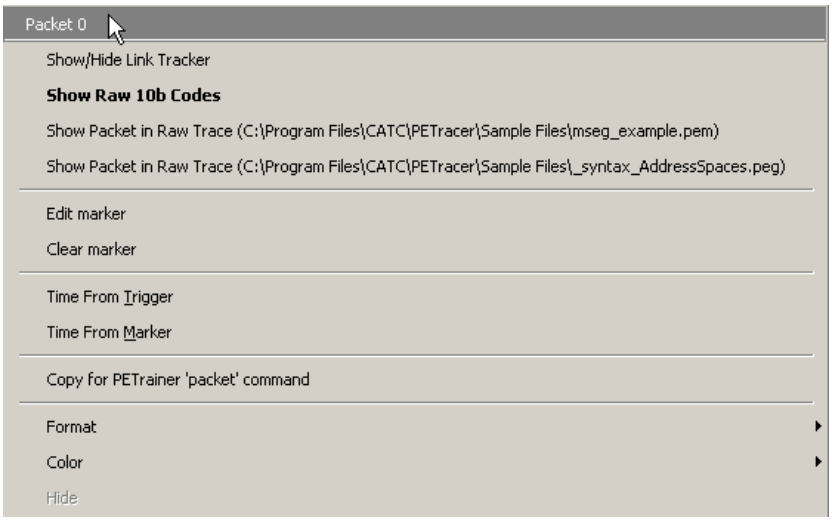


Later, you can go directly to this packet using the Go To Marker operation in the Search Menu.

5.10 Edit or Clear Marker

To change a markers identifier, or clear (delete) the marker:

Step 1 Left-click the **Packet** field of the desired packet to display a pop-up menu:



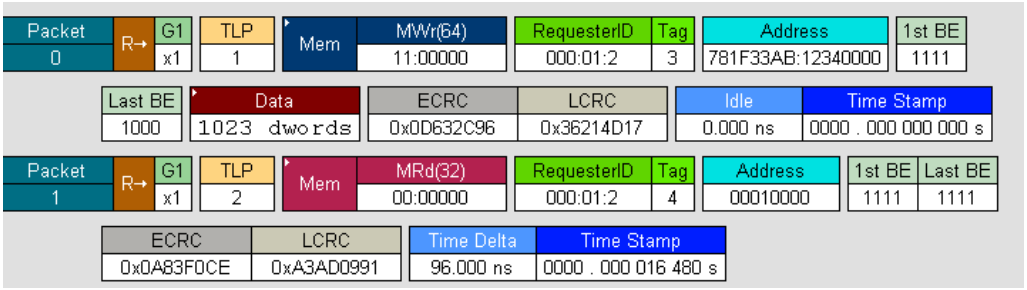
Step 2 Choose **Edit Marker** and enter a new identifier into the Edit Marker for Packer # pop-up, or
Choose **Clear Marker**. When you choose Clear Marker, the marker is removed and the red line disappears.

5.11 Decoding Traffic

The SimPASS PE software has three decode levels:

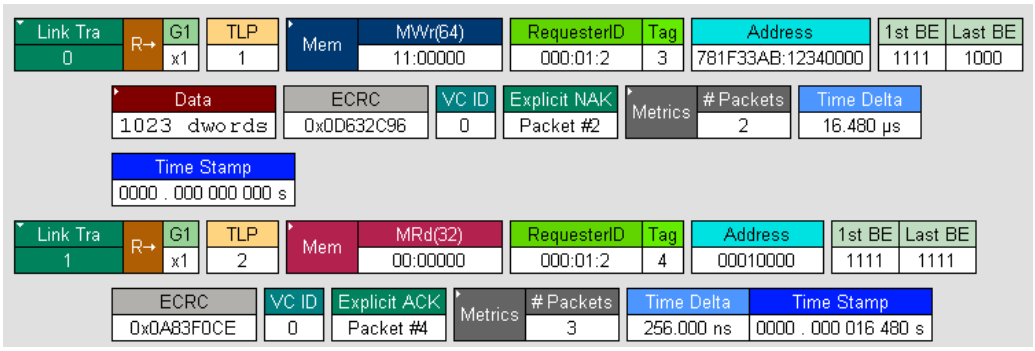
Packet

Packet level decode Pkt includes all TLP packets, DLLP packets, and all ordered sets.



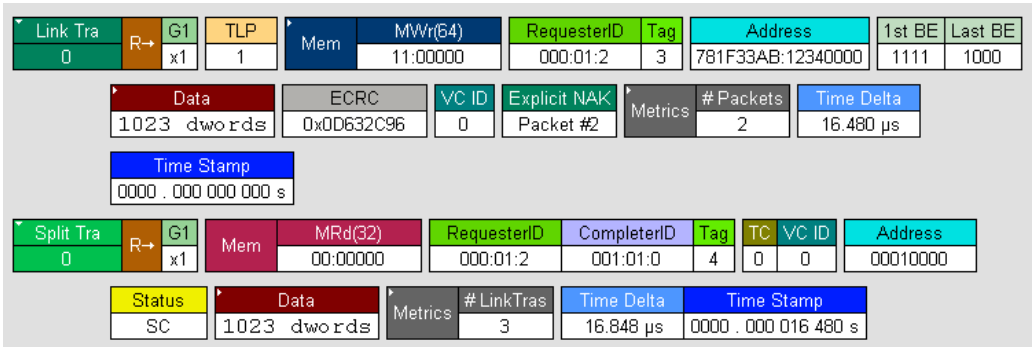
Link

Link level decode Link is composed of TLP packets matched with a corresponding ACK or NAK coming from the opposite direction.



Split

Split level decode Split is composed of two Link transactions, the Request TLP and the Completion TLP from the other direction.



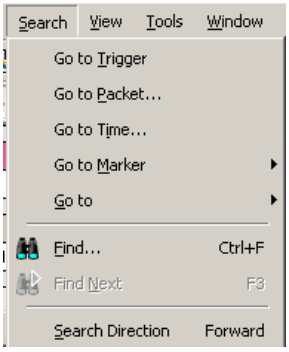
Chapter 6: Searching CATC Traces

This chapter describes how to search for CATC Trace events.

6.1 CATC Trace Search Overview

Several search commands let you navigate a CATC Trace view to search for key events, such as errors and triggers.

To view the search options, click **Search** in the Menu bar.



6.2 Go to Trigger

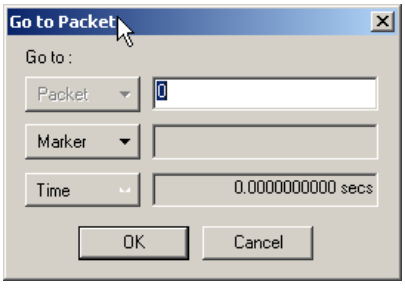
To position a trigger packet at the top of the screen:

- Select **Search > Go to Trigger**.

6.3 Go to Packet

To position a packet at the top of the screen:

Step 1 Select **Go to Packet** from the Search menu. A pop-up menu prompts you for the packet number, marker, or time.



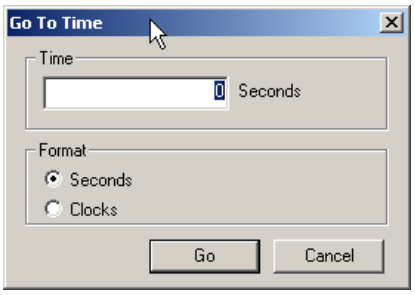
Step 2 Enter the packet number, marker, or time.

Step 3 Click **OK**.

6.4 Go to Time

To position a specific time at the top of the screen:

Step 1 Select **Go to Time** from the Search menu. A pop-up menu prompts you for the time in Seconds or Clocks.



Step 2 Enter the time and format (seconds or clocks).

Step 3 Click **Go**.

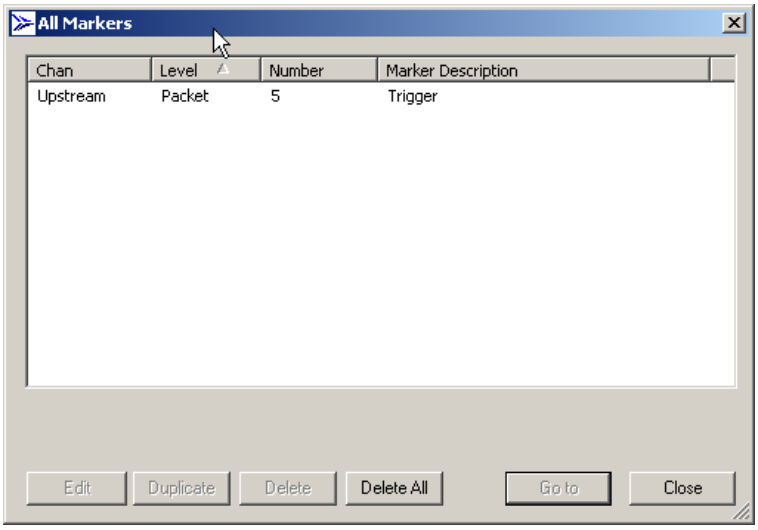
6.5 Go To Marker

Use this operation to go directly to a specific packet that has been marked with a unique marker by the Set Marker operation.

To go to a marker:

Step 1 Select **Go To Marker** from the Search Menu.

Step 2 Select the marker you want from the fly-out menu.
Alternatively, select **All Markers** to display the All Markers window, then select a marker and click **Goto**.



The packet you want appears at the top of the screen. Marked packets have a red bar on the left edge.

6.6 Go To Menu

The **Go To menu** in the Search menu provides a quick way to search for a packet based on a simple condition. You can search for the following types of events:

- TLP Type
- DLLP Type
- Ordered Set
- Link Event
- Traffic Class
- DLLP Virtual Channel
- TLP Virtual Channel
- Direction
- Speed
- Link Width
- Requester ID
- Completer ID
- Data Lengths
- Errors

6.7 Search Direction

Search direction can be toggled back and forth by using the command under the Search menu. Search Direction controls the direction of the search. Each time Search Direction is selected, the search order is reversed. For example, if the previous search was **forward**, choosing **Search Direction** toggles the current search to **backward**.

To verify the direction of a search look at the lower right corner of the screen. **Search: Bwd** or **Search: Fwd** should appear. If a direction is not indicated, it means that the status bar is turned off.

To turn on the Status bar, select from the menu **View > Status Bar**.

Keyboard shortcuts can also be used to control search direction:

- **Control-f** means Search Forward.
- **Control-b** means Search Backward.

6.8 Find

Find allows you to conduct complex searches in a CATC Trace. You can search by protocol level (Packets, Link Transactions, Split Transactions).

You can search packets by Event Group: TLP Type, TLP Header, TLP Prefix (Summit T2-16 only), TLP Requester ID, TLP Completer ID, TLP Data Pattern, TLP Data Lengths, TLP Tag, TLP Sequence Number, DLLP Type, DLLP Header, DLLP Virtual Channel, ACK/NAK Seq Number, Ordered Sets, Link Event, Direction, Errors.

You can search link transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

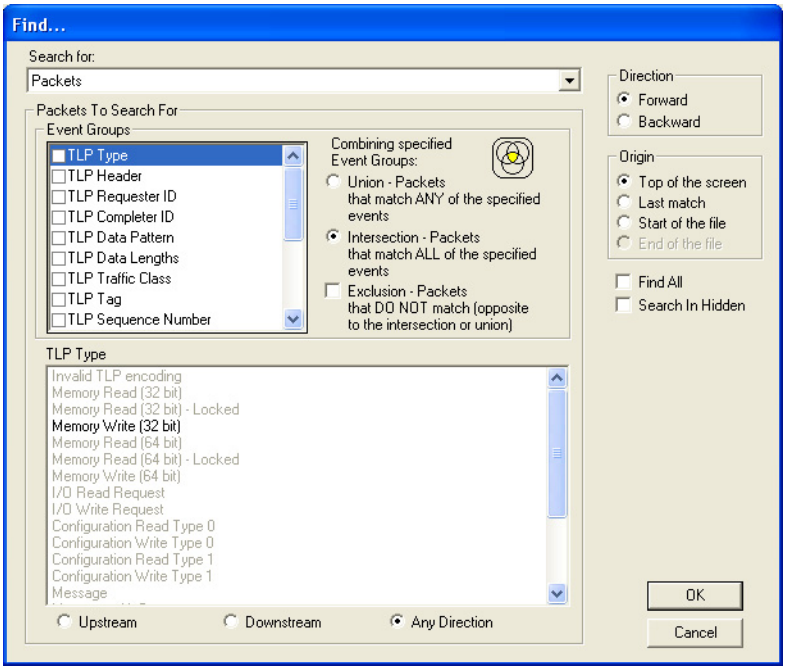
You can search split transactions by Event Group: TLP Type, Traffic Class, Virtual Channel, Direction, Requester ID, Completer ID, Status, Tag.

The options Union, Intersection, and Exclusion allow you to create complex searches such as “Find x OR y” or “Exclude all x or y.”

To find a item:

Step 1 Open a CATC Trace.

Step 2 Open Find by selecting **Search > Find** from the menu or clicking .



Step 3 From the Search For menu, select a display level such as **Packets**. To search multiple levels, finish steps 3 to 9, and then repeat 3 to 9 for each additional display level.

Step 4 From the Event Groups menu, select an **Event Group**. The menu in the far right of the dialog box is context sensitive and changes to reflect the options for that group.

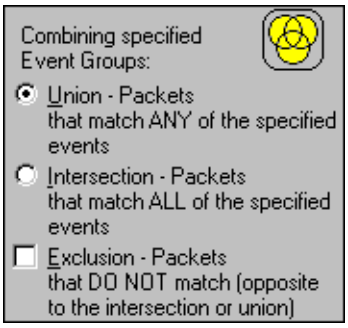
Step 5 In the menu in the far right, select one or more items.

Step 6 Repeat Step 5 for each Event Group of interest for the selected display level.

Step 7 Under Direction, select **Forward** or **Backward** to select a search direction.

Step 8 Under Origin, select a starting point for the search.

Step 9 Under **Combining Specified Event Groups**, select



The options Union, Intersection, and Exclusion let you set conditions on your searches:

- **Union**: To search for **any** of the selected criteria.
  Example: “Find packets with ANY of the following characteristics …”
- **Intersection**: To search for **all** of the selected criteria.
  Example: “Find packets with ALL of the following characteristics …”
- **Exclude**: To **exclude** items from a search. This option works in conjunction with Union and Intersection. You select Union and Exclude to exclude any of the specified traffic. You select Intersection and Exclude to exclude all of the specified traffic.
  Example: “Exclude packets with ANY of the following …” or “Exclude packets with ALL of the following …”

Step 10 Repeat Steps 3 through 9 for additional display levels.

Step 11 **Find All** displays all matching packets or transactions in a separate view.

Step 12 **Search in Hidden** includes hidden packets or transactions in the search.

Step 13 Click **OK**.

Event Groups

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Prefix (Summit T2-16 only)
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors

The Event Groups for Link Transactions and Split Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

6.9 Search for the Next Packet Type

Use **Find Next** or click to search for the next packet meeting the search criteria.

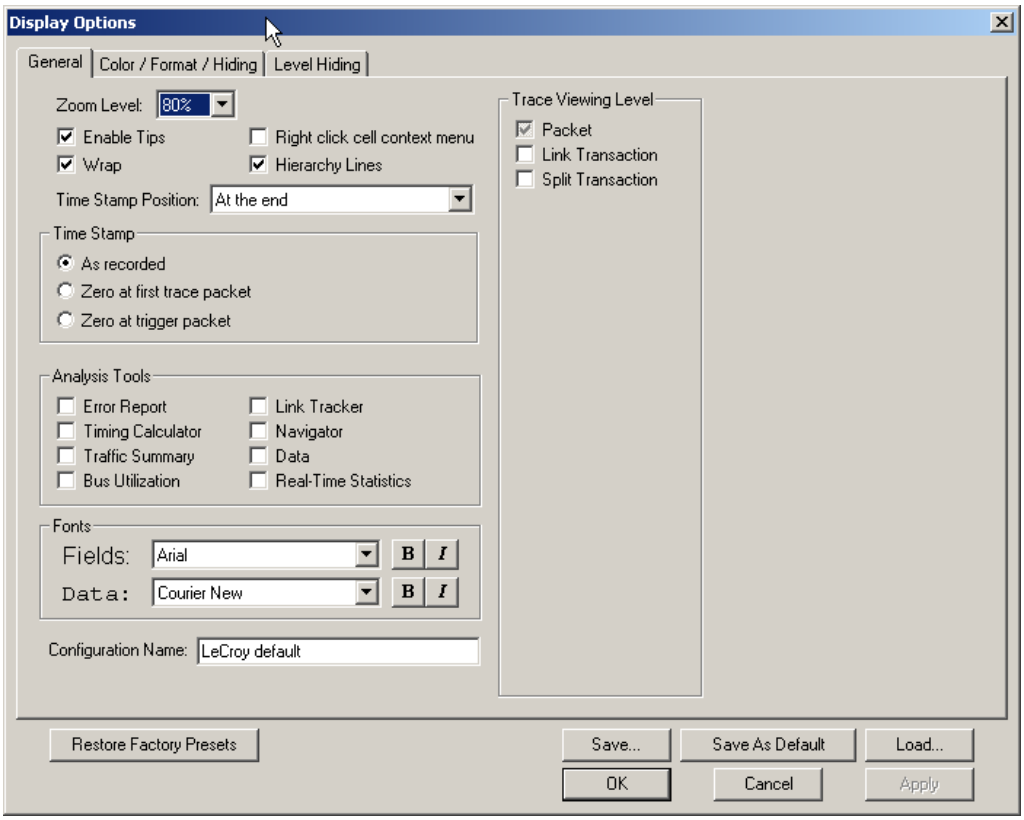
Chapter 7: Display Options

7.1 Setting Display Options

Display Options allow you to customize the colors and formats of displayed traffic.

To open the Display Options dialog at the General tab, Select **Setup > Display Options** from the menu or

click the **Display Options** button on the toolbar.



7.2 Specifying General Display Options

The Display Options General tab allows you to specify:

Zoom Level: Defines the size of packet fields in the packet view. Zoom level is adjustable as 10, 20, 40, 60, 80, 100, 120, 140, 160, 180 and 200 percent.

Enable Tool tips: Allows information to be displayed on a packet by resting your mouse pointer over it.

Wrap: Allows packets, Link Transactions, and Split Transactions to wrap within the display.

Right click cell context menu: Swaps mouse functions.

Hierarchy Lines: Adds lines to the trace view indicating relations between packets, Link Transactions, and Split Transactions.

Timestamp position: Moves timestamp location from end of packet to beginning of packet, or merges it with the packet number.

Trace Viewing Level: Allows the CATC Trace to be displayed in different hierarchical levels: Packets, Link Transactions, and Split Transactions.

Time Stamp: Gives you options for setting the timestamp to zero for either the first CATC Trace packet or the trigger packet or for leaving the stamp unchanged as it was originally recorded.

Analysis Tools Checkboxes

Error Report: Opens Traffic Summary window and displays list of errors that occurred in the CATC Trace.

Timing Calculator: Opens Timing Calculator dialog for calculating timing between events.

Traffic Summary: Displays a table of events that occurred in the CATC Trace.

Bus Utilization: Opens a graph of bus usage in the open CATC Trace.

Link Tracker: Opens window that displays traffic on a per lane basis in a strictly chronological view.

Navigator: Displays/Hides Navigation bar. The Navigation bar lets you see in a glance the position of errors and triggers in a CATC Trace and narrow the range of traffic displayed in the CATC Trace window.

Data: Displays packet payload information in various formats.

Real-Time Statistics: Opens a dialog that displays a graph of bus activity on the DUT in real-time, as well as other statistical information.

Fonts

Fonts: Allows the appearance of field text and/or data text to be defined.

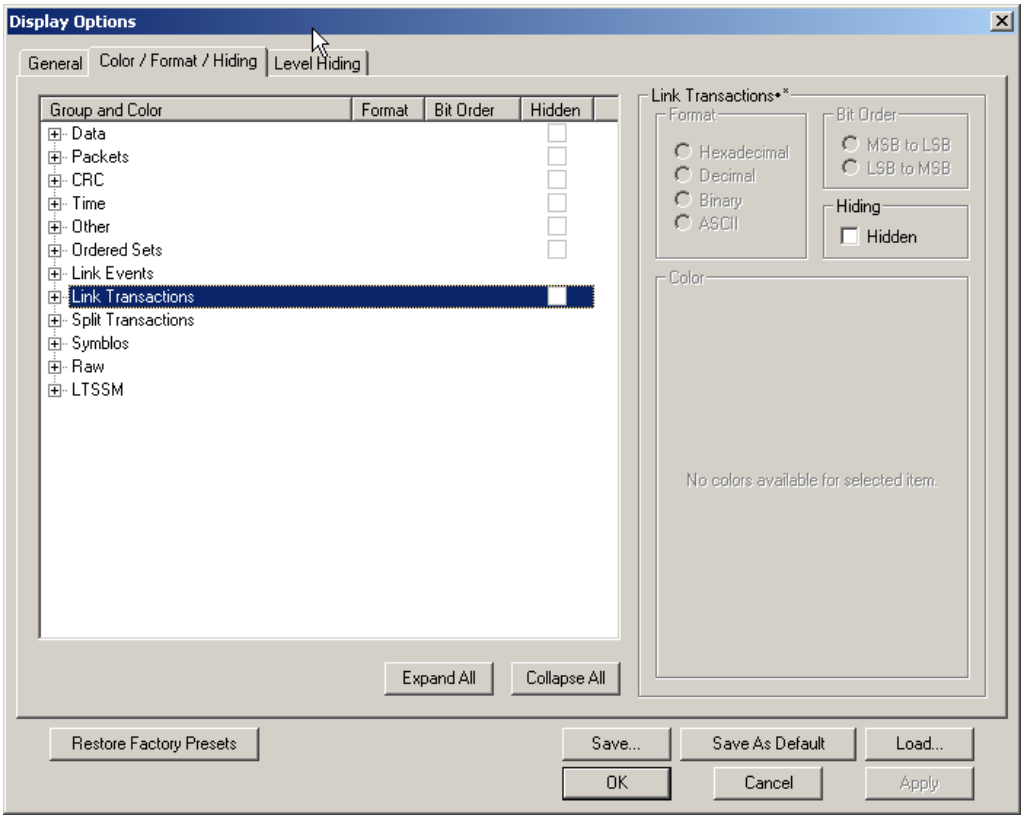
Configuration Name

Display Configuration Name: This field is used to enter a text string to be associated with the current set of Display Options. This name is saved with the Display Options file, and appears as part of the title of the packet view window that uses this set of Display Options.

7.3 Color, Format, and Hiding Options

The Color/Format/Hiding tab allows you to customize the colors and formats associated with each field in the CATC Trace and to selectively hide fields or packets. You access these display options by selecting **Setup > Display Options > Color/Format/Hiding** tab.

The Color/Format/Hiding property page lets you set how fields display in a CATC Trace. This property page lets you set field color and data format (binary, hex, decimal, ASCII), and lets you hide selected fields from the display.



Setting Field Colors

The Field Colors tab allows you to customize the colors associated with each field used in the packet view.

You may experiment with this option to achieve a color combination that suits you.

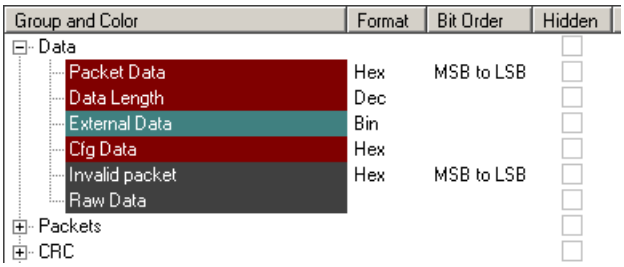
Select or change the trigger color using the color buttons labeled **- Packet #** and **+ Packet #** (before and after trigger) found under the Packet# section of the Field Colors window.

You select or change a color by clicking the appropriate color button. This action causes a color palette to pop up. Select the desired color and press OK.

Step 1 Click **View > Set Display Options** to open the Display Options dialog box.

Step 2 Select the **Color/Format/Hiding** property page.

Step 3 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group you want to reformat. The group expands to show the individual fields within the group. Each field has a color, as shown below:



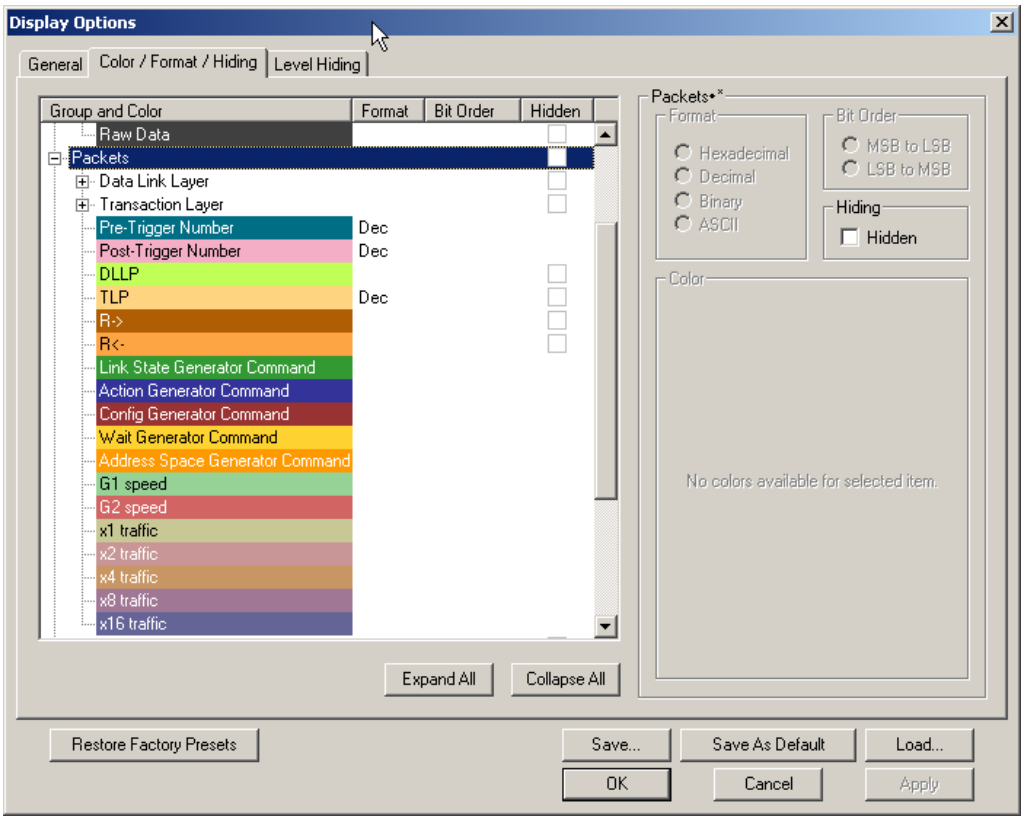
Step 4 Click the colored cell that you want to change. A color palette appears.

Step 5 Click a color in the palette, then click **Apply** or **OK**.

Note: The colors of the following Frame types cannot be changed:

- Invalid Data (frame error) field (red)
- Softbit Errors (yellow)

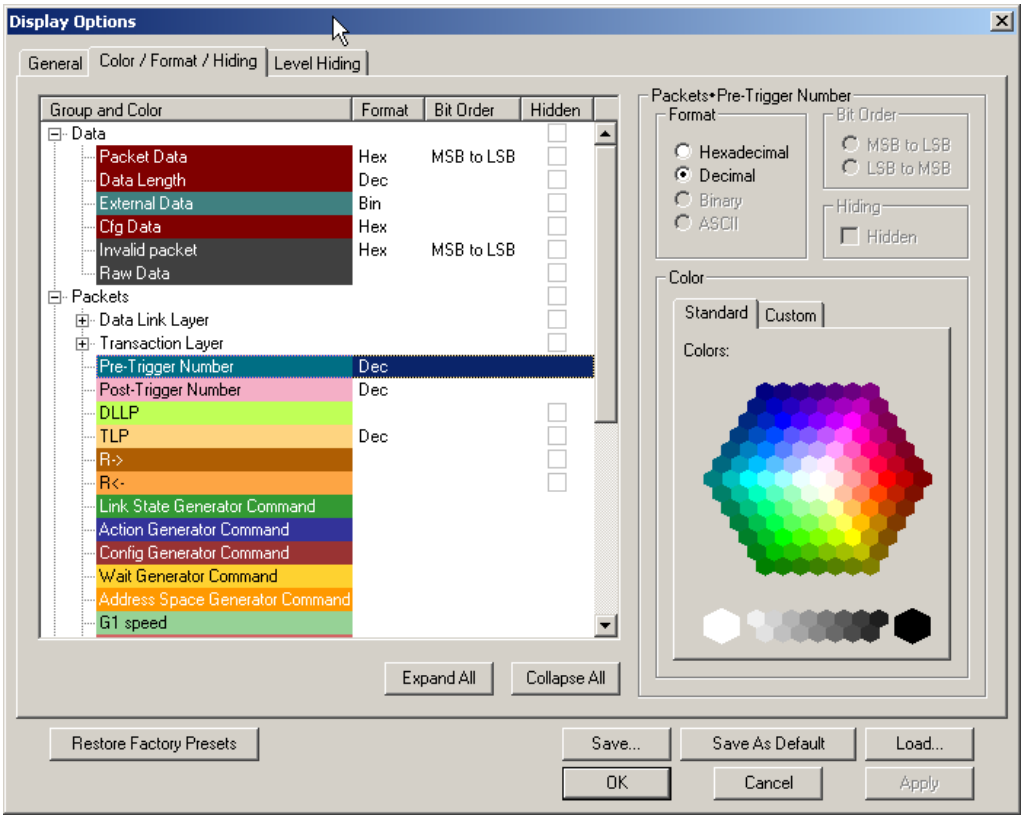
You can also change color by left-clicking a field in the CATC Trace and selecting Color from the pop-up menu.



Changing Field Formats

The Field Formats tab allows you to define the way various numeric fields are shown in the packet display. You can select Hexadecimal, Decimal, Binary, or ASCII for certain fields or groups of fields.

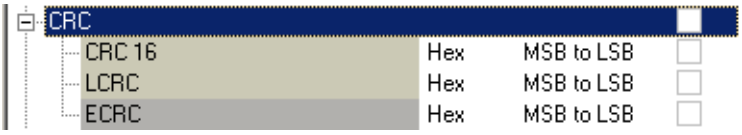
To change a field's format, click the plus sign (+) next to a field in the list. This causes the selected item to expand so you can see its constituent sub-fields. Select a sub-field, and then choose the format from the formatting choices that appear at the bottom of the window.



To change the format of alphanumeric characters in a field:

Step 1 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group you want to reformat. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **row** representing the field that you want to reformat. If the field can be reformatted, the format options at the top of the dialog box become active, as shown below:



Step 3 Select a **format**.

Step 4 Specify the bit order in the displayed fields by checking/unchecking the **MSB > LSB** checkboxes.

Step 5 Click **Apply** or **OK**.

Hiding Fields

To hide a field:

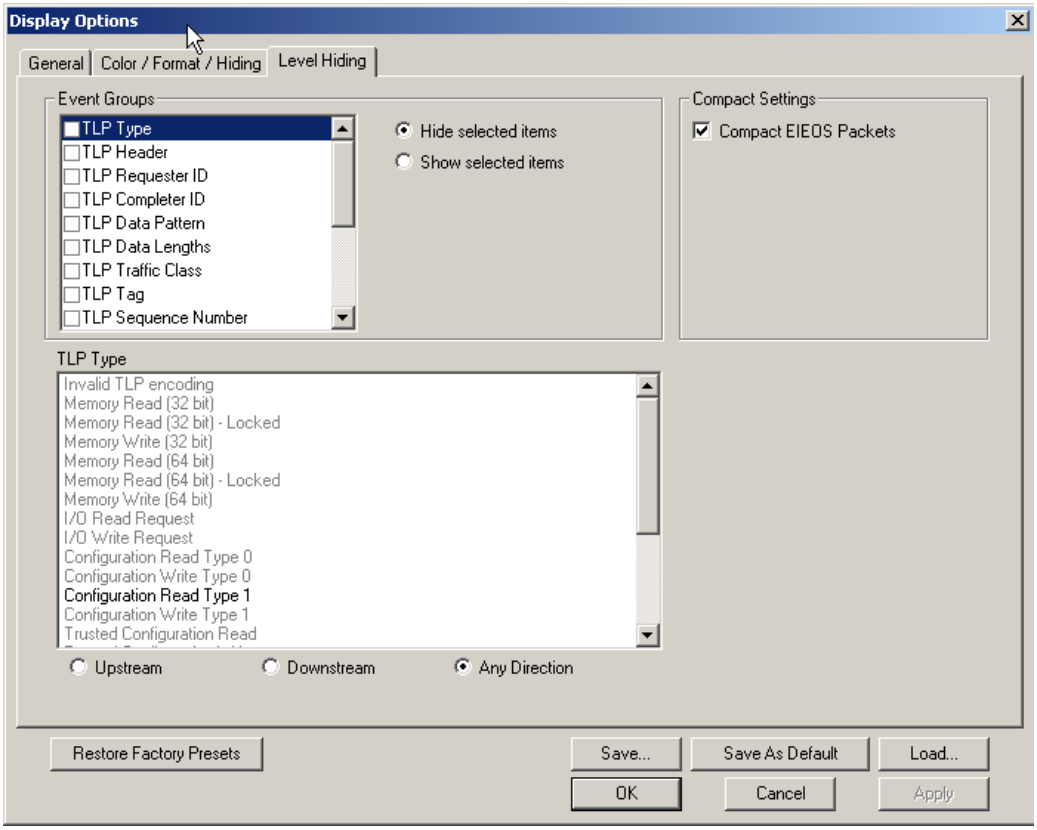
Step 1 Under the Group and Colors column, click the **plus** symbol (**+**) next to the group that has the field(s) you want to hide. The group expands to show the individual fields within the group (as shown above).

Step 2 Click the **checkbox** in the row representing the field that you want to hide.

Step 3 Click **Apply** or **OK**.

Hiding Levels

The Level Hiding page lets you hide traffic by Event Group. If you select one or more event types from the Event Group list, the selected types are hidden from the CATC Trace.



To hide a level:

Step 1 Select an Event Group.

Step 2 Select whether to **Hide** or **Show selected items**.

Step 3 Select **Upstream, Downstream**, or **Any Direction**.

Step 4 (optional) Select **Compact EIEOS packets**.

Step 5 Click **OK**.

The Event Groups for Packets are:

- TLP Type
- TLP Header
- TLP Requester ID
- TLP Completer ID
- TLP Data Pattern
- TLP Data Lengths
- TLP Traffic Class
- TLP Tag
- TLP Sequence Number
- DLLP Type
- DLLP Header
- DLLP Virtual Channel
- ACK/NAK Seq Number
- Ordered Sets
- Link Event
- Direction
- Errors

The Event Groups for Link Transactions and Split Transactions are:

- TLP Type
- Traffic Class
- Virtual Channel
- Direction
- RequesterID
- CompleterID
- Status
- Tag

7.4 Load a Previously Saved Display Options File

If you have previously saved Display Options, you can load them by opening the Display Options dialog and clicking the **Load** button. A dialog box opens to let you load a previously saved display options file.

Step 1 Click **Load** to use a previously defined display options file.

Step 2 When you see the Open File pop-up window, enter the name of the file you want to load and click **Open**.

Step 3 When the SimPASS PE™ software returns you to the Recording Options menu, click **OK** to activate the display options you selected.

7.5 Saving Display Options

If you have customized the Display Options and wish to save them, you can do so by clicking the **Save** button, then entering a unique file name. The **.opt** extension is added by default.

Setting the Defaults: Save the currently specified Display Options to the file name: **default.opt** by clicking **Save As Default.** When the Analyzer software begins execution, it automatically loads the **default.opt** file, if one exists.

Chapter 8: BitTracer Trace Files

8.1 Overview

Note: BitTracer is an optional feature.

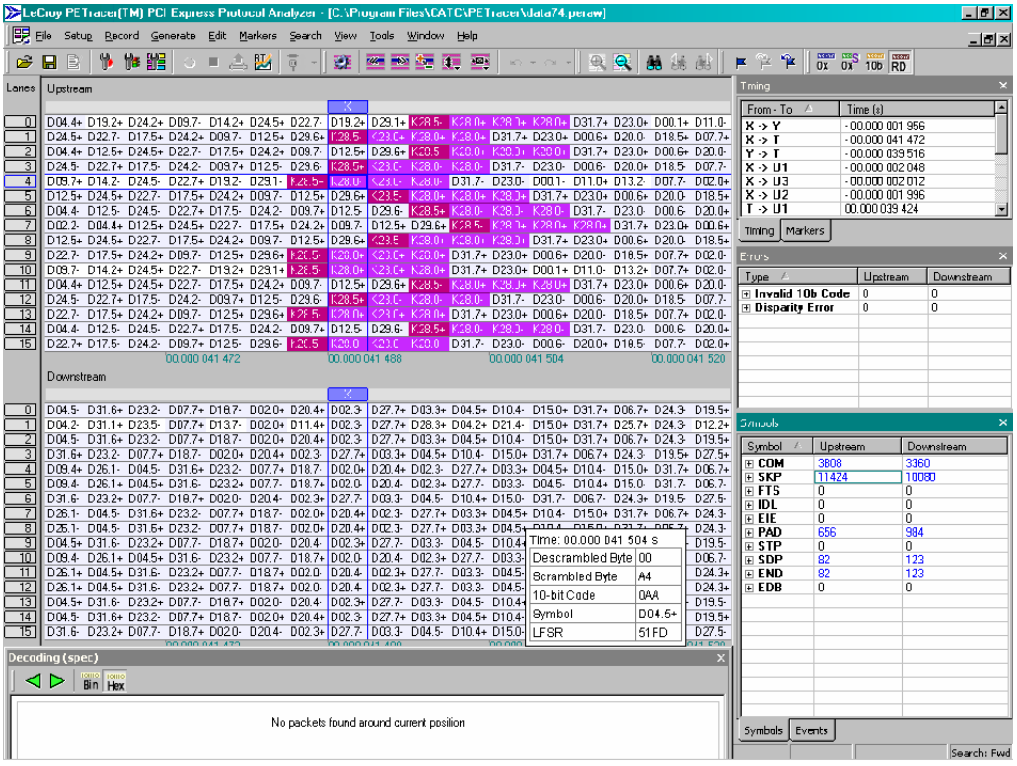
BitTracer displays bi-directional link traffic in raw format. The BitTracer mode captures and displays traffic before lane-to-lane de-skew operations and before descrambling of 10b bytes. The BitTracer mode includes support for multiple logical links (bifurcations) on a single physical link.

The BitTracer mode has its own user interface, which provides characterizations of link traffic that are not available in the standard protocol analyzer mode.

You can export BitTracer recordings for viewing in CATC Trace format.

8.2 Views Available for Captured Data

BitTracer mode displays captured data lane-by-lane and byte-by-byte in each direction (upstream and downstream), with the time scale progressing left to right.



Other views are provided for timing measurements, marker placement, physical layer errors, captured symbol types, packets, events, and decoding of ordered sets and packets. You can view any or all displays simultaneously, using the **Windows** selection in the View menu.

8.3 De-Skewing Data

By default, BitTracer recordings display captured data in a raw, time-skewed format, across all lanes in both directions. Individual bytes are as they were captured on the recorded link, before the receiver device on the link (or the receiver logic on the SimPASS PE analyzer) has performed lane-to-lane de-skew operations.

You can manually skew the captured data, left or right, in increments of one symbol time, using the associated toolbar buttons.

You can automatically de-skew an entire lane direction. First, left-click on the direction in the data window. Then right-click to display a popup menu. Then select **Auto De-Skew**.

You can de-skew only one direction for each right-click operation. To automatically de-skew the opposite direction, first left-click on that direction in the data window.

8.4 Data Display Formats

To display traffic in K/D symbol (with Running Disparity indicated), scrambled, descrambled, 10-bit, and Binary code formats:

- Use the toolbar.

- Right-click to display a menu.
- Place the cursor over any given byte to display all byte formats (including an LFSR value) in pop-up list.

Time: 00.000 003 016 s

Descrambled Byte	1C
Scrambled Byte	1C
10-bit Code	30B
Symbol	K28.0+
LFSR	FFFF
Decoding	SKP

Note: Descrambled values can only be displayed after the first recorded skip ordered set. Data prior to the skip is displayed in scrambled values, due to the unknown LFSR.

Note: For Binary Data Display Format, bits are shown in order of transmission on the bus.

8.5 Color-Coding of BitTracer Contents

To increase visual understanding of BitTracer displays, different symbol types have color-coding:

- Presence or non-presence of a lane's byte-lock
- Idle data characters (D0.0)
- K codes
- Invalid 10b symbols
- Signal presence
- Background of the Markers Bar (see "Markers Bar" on page 49) (color coded according to traffic speed).
- All symbols of a TS1/TS2 ordered set

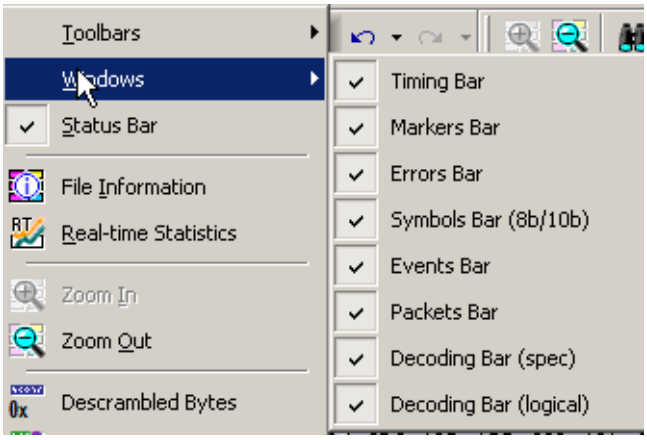
By default, these color selections match the standard color selections used in the CATC Trace format. You can modify them in the Display Options menu, accessible from the Main toolbar or the Setup menu.

8.6 Report and Analysis Windows

In the report windows, BitTracer mode provides several functions to analyze traffic:

- Statistical information
- Timing measurements
- Packet decoding

To activate/deactivate a report window, use **Views > Windows**.



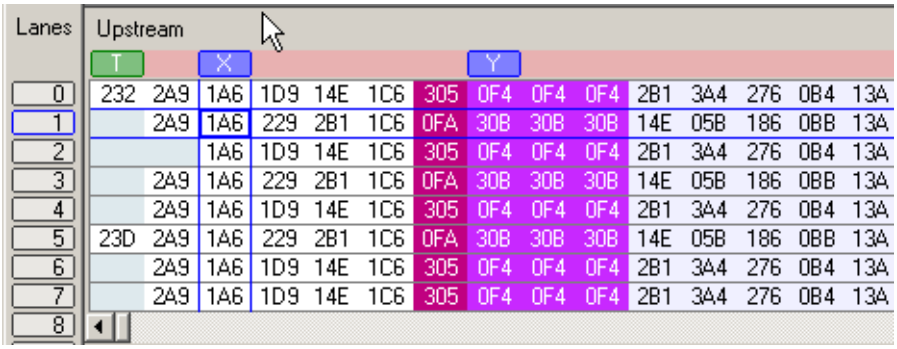
You can rearrange the report windows.

All report windows are dockable.

8.7 Timing Measurements Bar

BitTracer mode provides timing measurements on captured data:

- Measurements from the Trigger position relative to user-selected X and Y markers
- X-Y measurements
- Measurements between user-defined markers



Markers Bar

The Trigger marker T is at the point where BitTracer recognized the user-defined trigger condition.

To set an X marker X, left-click anywhere in the data display, except for the light gray bar located above the data and below the directional label.

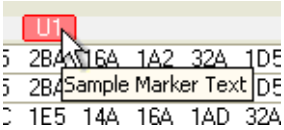
To set a Y marker Y .right-click anywhere in the data display, except for the light gray bar located above the data and below the directional label.

To define a marker, select the **Set Marker** command in the Markers menu or use the **Toggle Marker** icons in the toolbar. You can also use the Jump to Next or Previous marker icons in the toolbar.

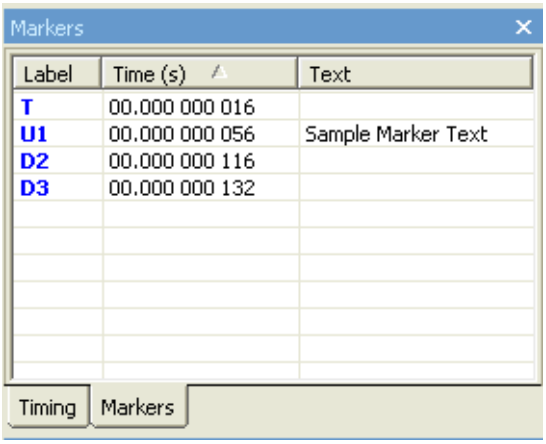
User-defined markers are numbered in order they were placed:

- U1 U1, U2, and so on in the upstream direction
- D1, D2 D2, and so on in downstream direction.

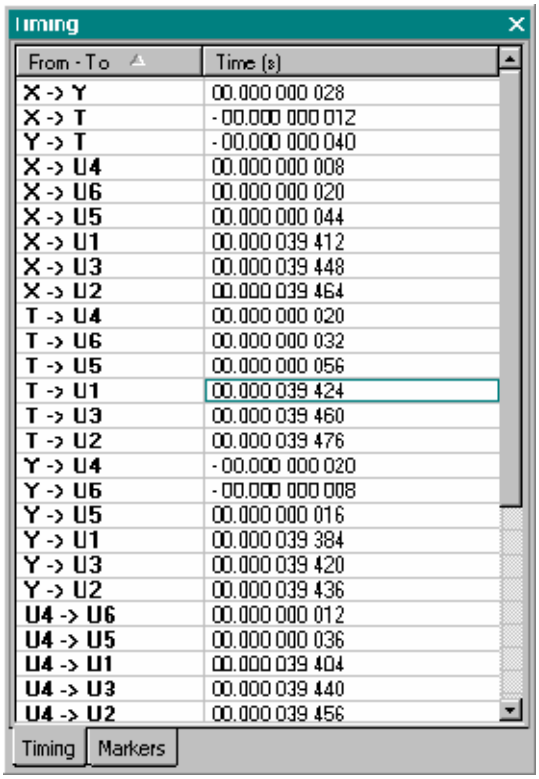
You can set a marker with text using the **Set Marker with Text…** command in the Markers menu. After setting the marker, when the mouse pointer is on the marker symbol, the marker text displays as a tooltip.



You can also display the Markers window, which lists all markers and their locations, including a hyperlink for each.

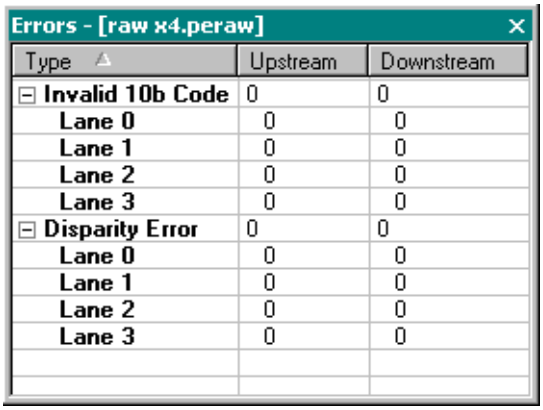


Timing measurements between all combinations of X, Y, U, and Trigger cursors are in the Timing window.



8.8 Errors Bar

BitTracer mode provides a summary of 10b errors (invalid symbols) and disparity errors in the Errors window. The window shows the total error count and errors per-lane for each error type. Hyperlinks allow jumps to selected errors.



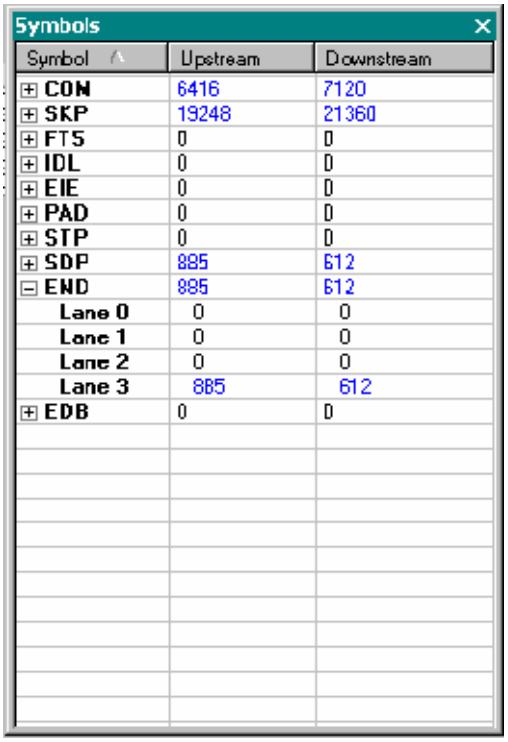
Type	Upstream	Downstream
Invalid 10b Code	0	0
Lane 0	0	0
Lane 1	0	0
Lane 2	0	0
Lane 3	0	0
Disparity Error	0	0
Lane 0	0	0
Lane 1	0	0
Lane 2	0	0
Lane 3	0	0

BitTracer mode also highlights errors:

- Invalid symbols have a black background.
- Bytes with incorrect running disparity have red borders.

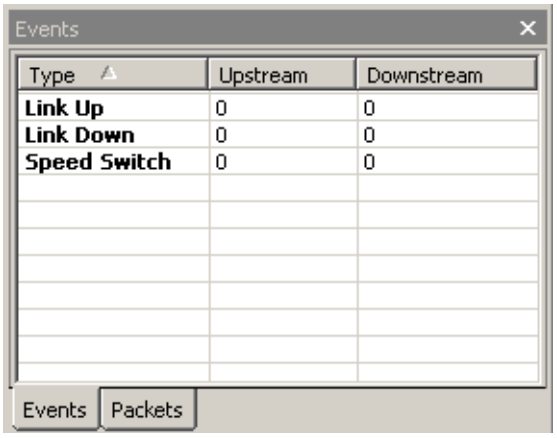
8.9 Symbols Bar

The Symbol window provides a summary of the different symbol types captured, by quantity and direction, and includes hyperlinks for jumps to selected symbols. Expanding the **+** sign at the left of each symbol provides a summary of symbols by lane.



8.10 Events Bar

The Events report window summarizes Link Up, Link Down, and Speed Switch events for Upstream and Downstream.



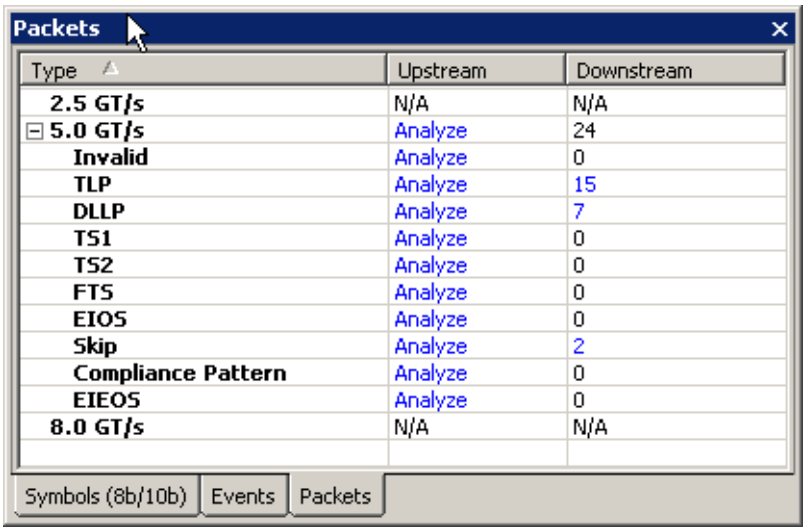
Note: The table entries are hyperlinks.

8.11 Packets Bar

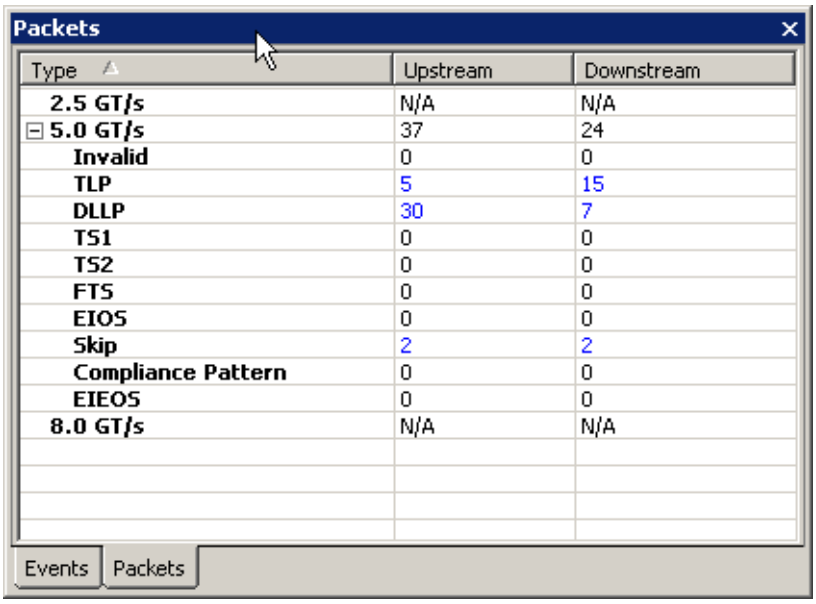
The Packets report window summarizes packet types detected in the file.

To obtain packet types, you must perform a post-capture “Analyze” step. After capture, when you open the Packets Bar for the first time, items can display the command “Analyze”. To start the analysis, click the word **Analyze**. After analysis finishes, the results are saved with the file. Therefore, you do not need to click **Analyze** the next time. **Note:** The table entries are hyperlinks.

Note: If you edit anything, the results are no longer valid, and the system requires you to click **Analyze** again.



After analysis, the Packets Bar looks like the following:



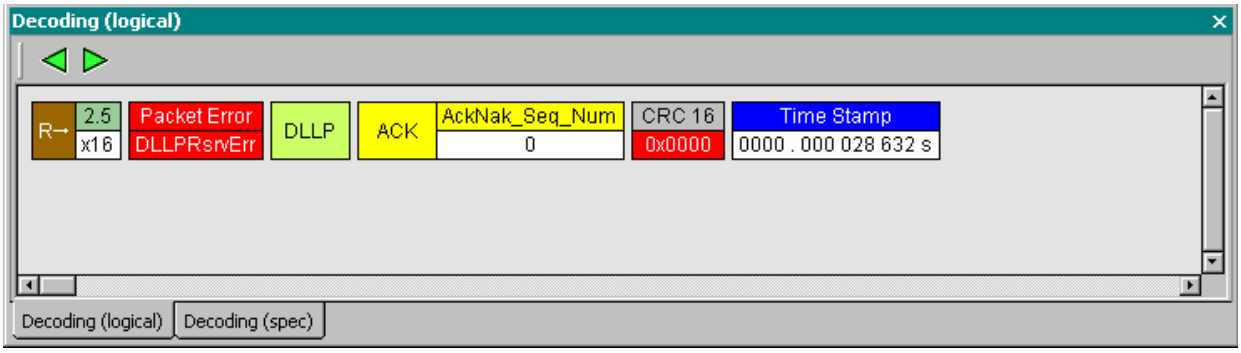
8.12 Decoding Bar

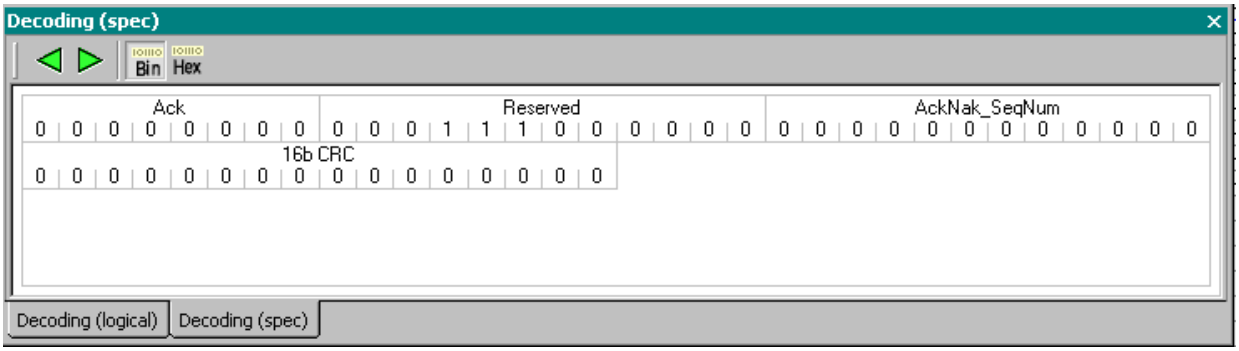
If you select them in the data view, or search or jump locates a feature, BitTracer mode displays ordered sets and packets in the Decoding window:

- **Logical view** is identical to CATC Trace format.
- **Specification view** provides a more elementary display. The Specification view includes an option to display data in hex or binary format.

Note: Packets and ordered sets translate directly to this view from data capture and use any post-capture skew manipulations you add, or use natural lane-to-lane skew present on the link if you have not added post-capture skew manipulations. Typically, you would perform an Auto De-Skew before viewing ordered sets and packets in this view.

Use the left and right arrows to search for the next or previous symbol type.

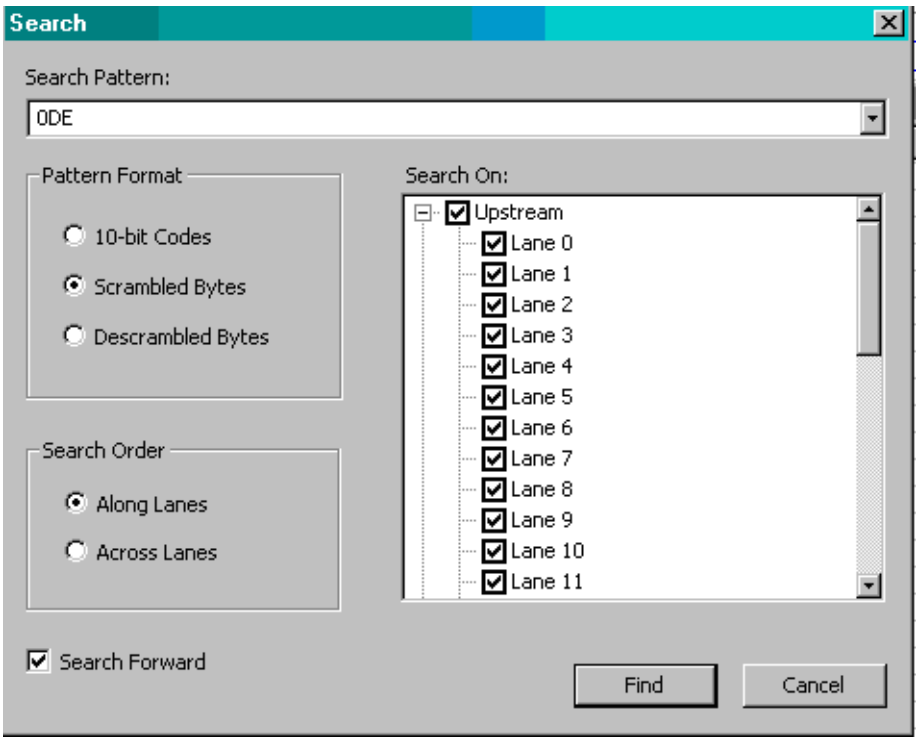



Decoding (spec)
Bin
Hex
Ack
Reserved
AckNak_SeqNum
0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
16b CRC
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
Decoding (logical)
Decoding (spec)

8.13 Search

To search, use the Search toolbar.

Clicking the **Search** icon displays the Search window.



You can copy data shown in the BitTracer display across a lane (horizontally) or across multiple lanes (vertically), and then paste it into the Search Pattern window.

The Search Pattern window stores previous search values, which you can recall by selecting the Search Pattern drop-down button.

In the Pattern Format section, select to search in 10-bit Codes, Scrambled Bytes, or Descrambled Bytes format.

In the Search Order section, select to search Across Lanes (multiple lanes, vertically) or Along Lanes (individual lanes, horizontally).

To define the direction (upstream or downstream) and the lanes on which to search, use the Search On section.

8.14 Link Configuration

Use the toolbar icon or right-click in the data views to display the Link Configuration dialog. This dialog allows you to associate logical lanes with physical lanes, thereby providing support for lane bifurcation (multiple logical links on the same physical link).

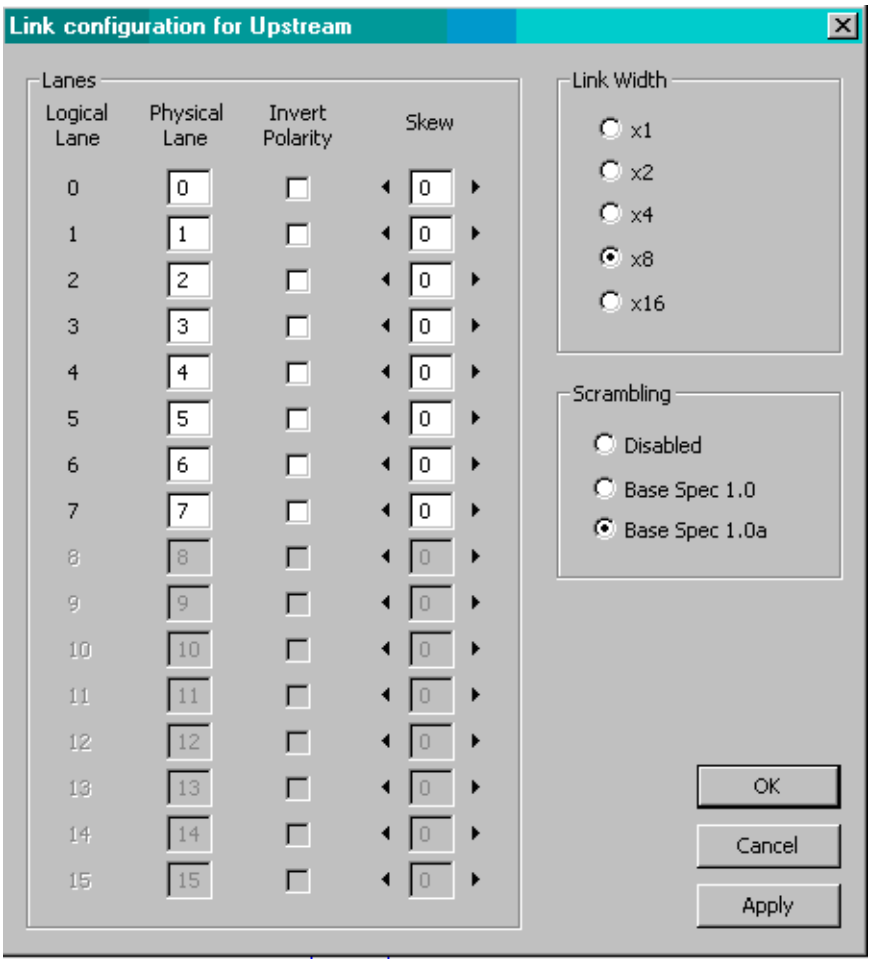
After logical lanes map to physical lanes, BitTracer mode reconfigures the display to show the selected logical link (and the logical link width, as the link width selected in the dialog).

Use the arrows to force symbol time skew on any lane.

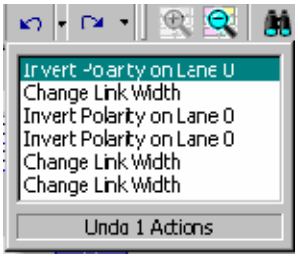
Use the polarity checkbox to invert lane polarity on the selected lane or use the **+/-** toolbar icon.

Use the scrambling option to select a scrambling algorithm, as per specification 1.0a or legacy specification 1.0.

Note: This dialog applies to one direction at a time (upstream or downstream). Left-click in the direction in the data display to edit the configuration for that direction.



As you perform operations that affect display configurations, the application records them. To undo or redo operations, use the Undo and Re-do icons on the toolbar.



8.15 Export of BitTracer Capture to CATC Trace Format

You can export BitTracer captures to standard CATC Trace file formats, selecting the **Export** option from the File menu. **Note:** You should use the Auto De-skew feature before using the export feature.

The exported CATC Trace keeps association information with the original BitTracer file. Such traces scroll synchronously when you select the **Synchronize Traces** option in the Windows menu.

You can navigate between BitTrace and CATC Trace using the **Show in Trace View/Show Packet in Raw Trace** context menu.

Exports Involving Multiple Logical Links on One Physical Link

If a single BitTrace capture contains more than one logical link, you can export each logical link to CATC Trace format. You may then cascade or tile the various BitTracer exports, which then scroll together in linked fashion, along with the original BitTracer file. The Export dialog provides options to export a limited range within the BitTrace capture and to automatically open the exported capture in CATC Trace format.

8.16 Compressing and Expanding the Data View

You can compress (zoom out) the horizontal timing of the displayed data to view higher-order link behaviors. You can expand (zoom in) to examine higher-resolution views.

To zoom in or zoom out, right-click the data view, then select a command or select a zoom icon on the toolbar.

Alternatively, to zoom in, left-click and drag across a desired range of data.

8.17 Opening and Saving BitTracer Captures

You can save BitTracer captures in various file types.

You can collate and archive these files for transport, using the **Export to Compressed Archive** feature in the File menu.

The main BitTracer files have a ***.peraw** extension.

You can open these files in the SimPASS PE application using the **File > Open** command.

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Chapter 9: Reports and Tools

Reports assist you in analyzing traffic recorded by the Analyzer. The available reports are:

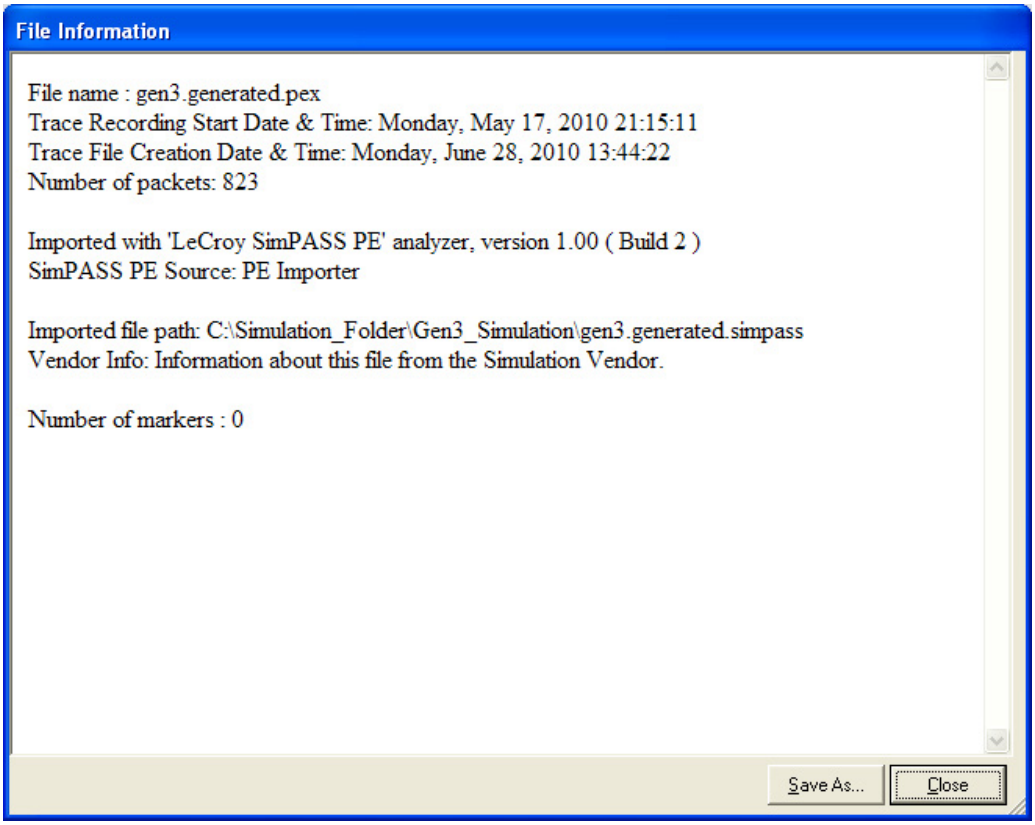
- **File Information**: To view general information about the CATC Trace file.
- **Error Summary**: To view a count of errors in a CATC Trace file.
- **Traffic Summary**: To view a summary of protocol-related information in the CATC Trace file summary information about a selected group of items in the CATC Trace file (such as a count of particular frame or packet types).
- **Bus Utilization**: To display information on bandwidth usage for the transmit and receive channels.
- **Link Tracker**: Displays a detailed chronological view of events.
- **Data Flow**: Shows marker, packet, direction, type, length, address, payload, handshake, and timestamp information.
- **Trace Navigator**: Navigates within the CATC Trace to view the location of errors and triggers, narrow the range of traffic on display, and jump to any point in the CATC Trace.
- **LTSSM Flow Graph**: Shows a state diagram of bus activity.
- **Packet Header**: Shows packet header information
- **Packet Data**: Shows packet information.
- **Configuration Space**: Displays a Configuration Space.
- **Metrics**: Measures key operating parameters.
- **TC to VC Mapping**: To display how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions).
- **Timing Calculations**: To view timing measured between two events set within the CATC Trace file.
- **Run Verification Scripts**: Allows you to check errors, link transactions, split transactions, metrics, ordered sets, replays, DLLPs, and TLPs.

Reports are available from the Report menu and buttons on the Tool bar. Tools are available from the Tools menu.

9.1 File Information

The File Information window provides a summary on the currently displayed file.

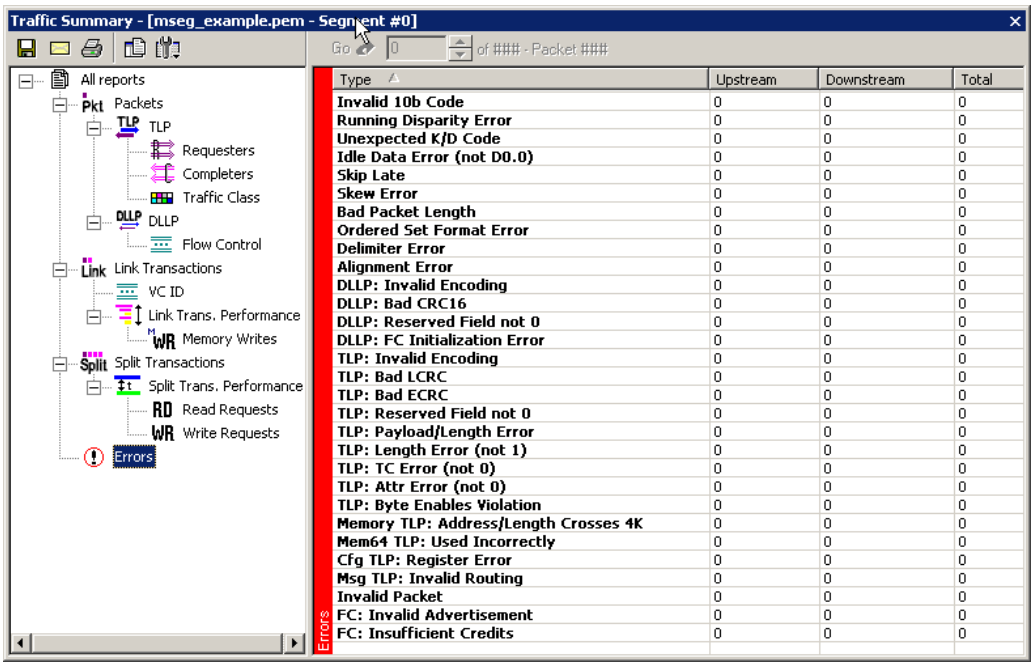
Select **Reports > File Information** to obtain the File Information window.


File Information
File name : gen3.generated.pex
Trace Recording Start Date & Time: Monday, May 17, 2010 21:15:11
Trace File Creation Date & Time: Monday, June 28, 2010 13:44:22
Number of packets: 823
Imported with 'LeCroy SimPASS PE' analyzer, version 1.00 (Build 2)
SimPASS PE Source: PE Importer
Imported file path: C:\Simulation_Folder\Gen3_Simulation\gen3.generated.simpass
Vendor Info: Information about this file from the Simulation Vendor.
Number of markers : 0
Save As...
Close

9.2 Error Summary

The Error Summary dialog box displays the number of errors for each event and the packet containing the errors.

Select **Reports > Error Summary** to obtain the Error Summary dialog box.

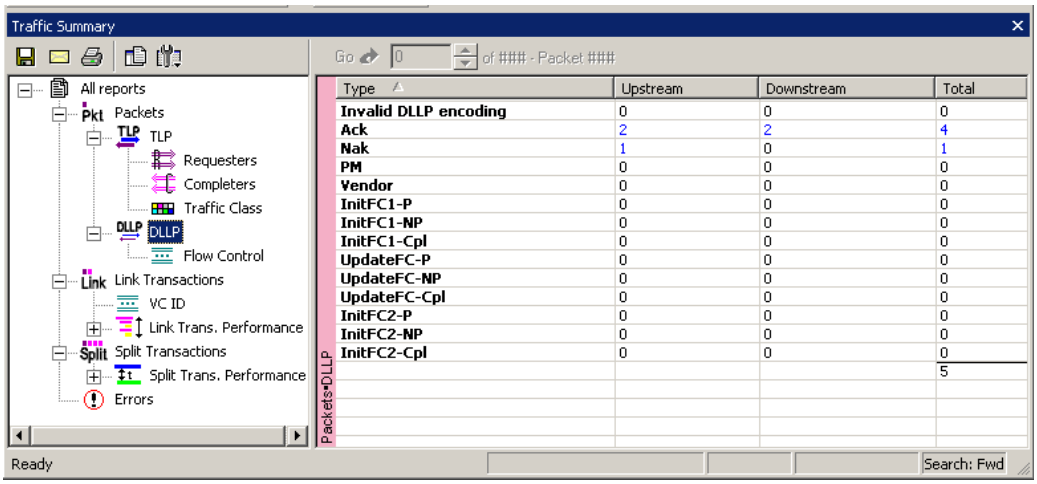


Type	Upstream	Downstream	Total
Invalid 10b Code	0	0	0
Running Disparity Error	0	0	0
Unexpected K/D Code	0	0	0
Idle Data Error (not D0.0)	0	0	0
Skip Late	0	0	0
Skew Error	0	0	0
Bad Packet Length	0	0	0
Ordered Set Format Error	0	0	0
Delimiter Error	0	0	0
Alignment Error	0	0	0
DLLP: Invalid Encoding	0	0	0
DLLP: Bad CRC16	0	0	0
DLLP: Reserved Field not 0	0	0	0
DLLP: FC Initialization Error	0	0	0
TLP: Invalid Encoding	0	0	0
TLP: Bad LCRC	0	0	0
TLP: Bad ECRC	0	0	0
TLP: Reserved Field not 0	0	0	0
TLP: Payload/Length Error	0	0	0
TLP: Length Error (not 1)	0	0	0
TLP: TC Error (not 0)	0	0	0
TLP: Attr Error (not 0)	0	0	0
TLP: Byte Enables Violation	0	0	0
Memory TLP: Address/Length Crosses 4K	0	0	0
Mem64 TLP: Used Incorrectly	0	0	0
Cfg TLP: Register Error	0	0	0
Msg TLP: Invalid Routing	0	0	0
Invalid Packet	0	0	0
FC: Invalid Advertisement	0	0	0
FC: Insufficient Credits	0	0	0

9.3 Traffic Summary

The Traffic Summary window summarizes the traffic in the current CATC Trace. The left side of the window displays a tree of protocol levels. The right side displays a summary of traffic for the displayed levels.

Select **Reports > Traffic Summary** or click to display the Traffic Summary window.



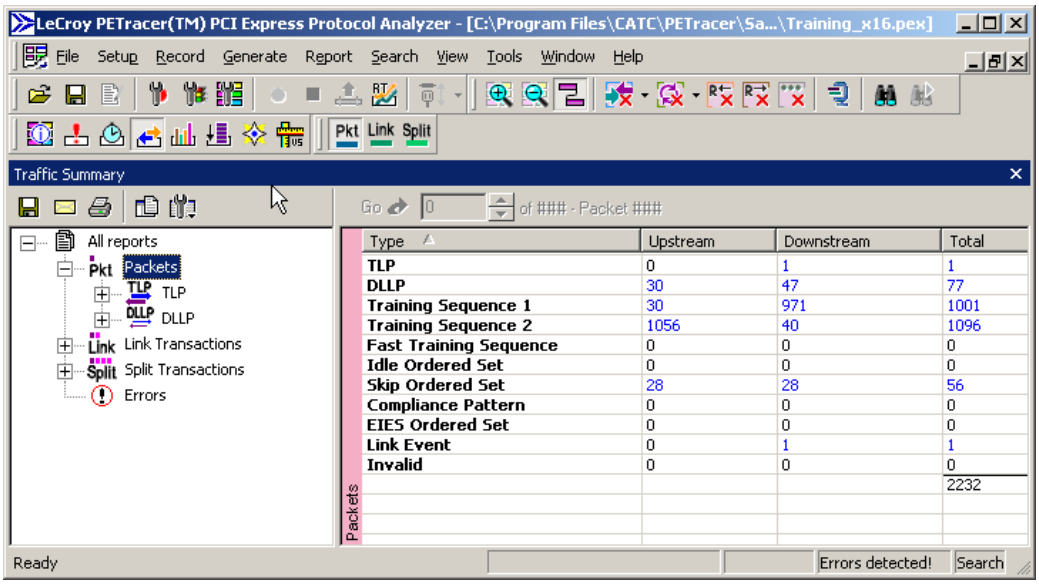
Buttons at the top of the Traffic Summary window change the display format and enable data to be exported to email, file, or the printer.

Using the Traffic Summary Window to Search the CATC Trace

You can use the Traffic Summary window to move the CATC Trace to packets of interest:

Step 1 Click one of the numbers in the right side of the Traffic Summary window.

The CATC Trace jumps to the first instance of the selected protocol.



Step 2 Click the **up** or **down** arrows . The CATC Trace jumps forward or backward through the display to the next instance of selected protocol level.

Traffic Summary Buttons

Buttons at the top of the Traffic Summary dialog box provide options for exporting the data or formatting its appearance:

Save. Saves Traffic Summary results into an HTML format.

Email. Attaches an HTML file of the results to a new email.

Print. Prints results.

Text. Displays results in HTML format.

Options. Opens a drop-down menu with the following options:

- **Grid Lines**: Displays/Hides grid lines
- **Row Selection**: Allows entire rows to be selected
- **Tight Columns**: Reformats column widths to match data
- **Event Navigation**:

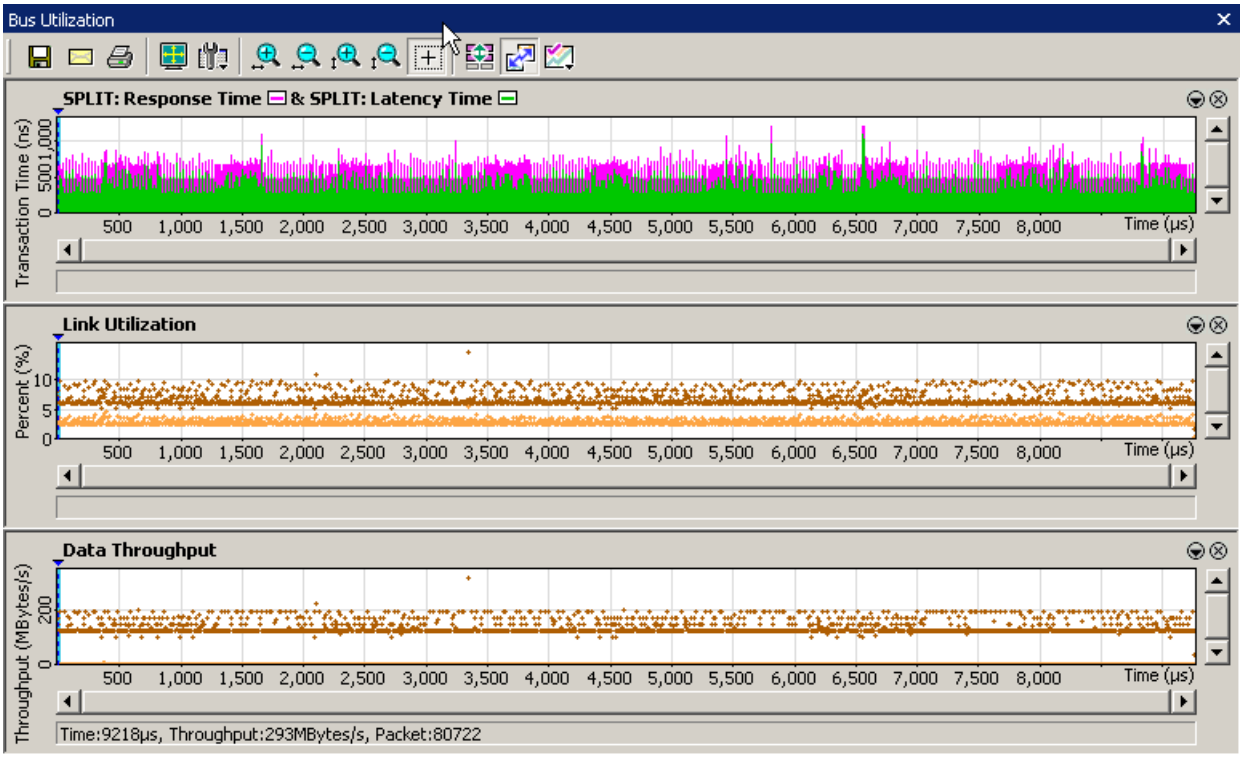
  Skip Hidden Items

  Show Hidden Items

  Prompt each time

9.4 Bus Utilization

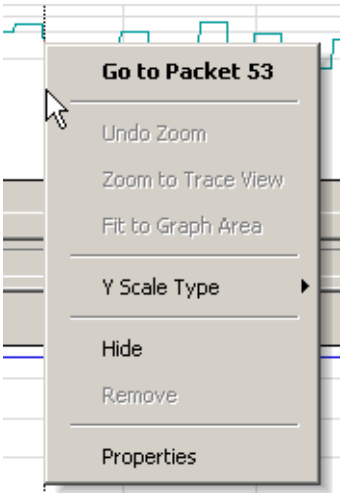
Select **Report > Bus Utilization** from the menu or press to open the Bus Utilization window.



The Bus Utilization window displays information on bandwidth use for the transmit and receive channels.

Bus Utilization Pop-up Menu

You can reformat the display by right-clicking a graph and making a selection from the Bus Utilization pop-up menu.



Go to Packet #: Relocates the CATC Trace to the selected packet number.

Undo Zoom: If you have zoomed in, this command undoes the zoom.

Zoom to Trace View: Zooms in on graph to show traffic currently displayed in the CATC Trace screen.

Fit to Graph Area: Redisplays graph so that the entire CATC Trace fits inside graph area.

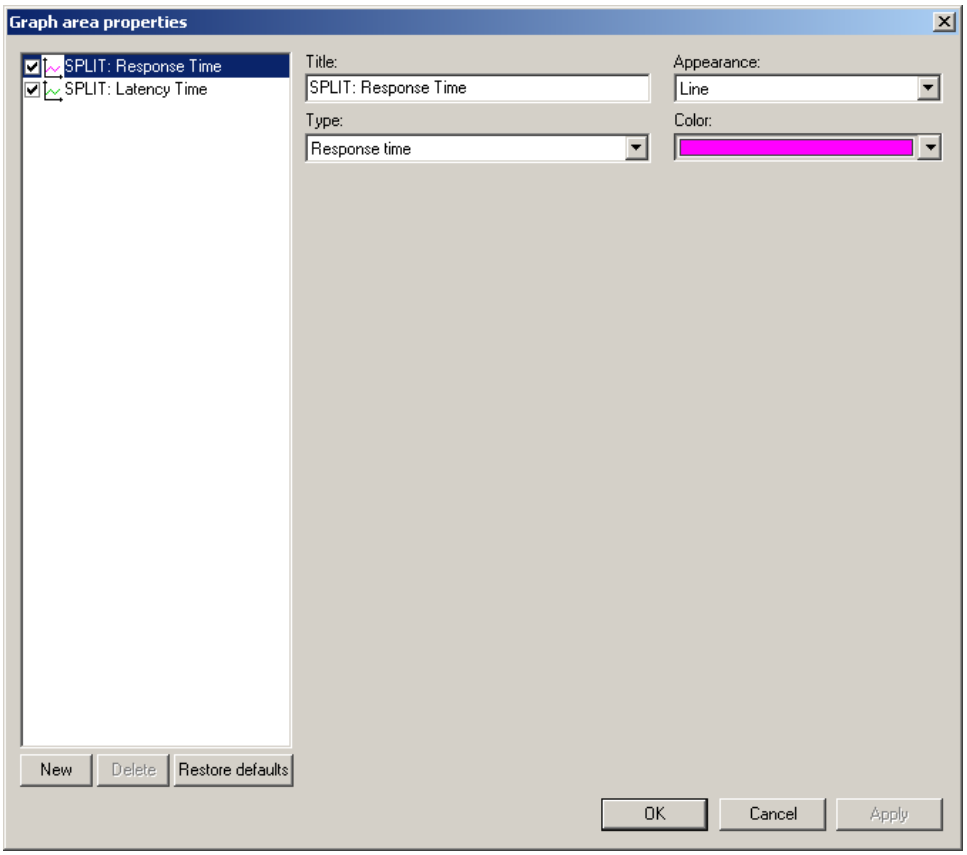
Y Scale Type:

- **Linear**: Converts display to linear format
- **Logarithmic**: Converts display to logarithmic format

Hide: Hides the selected graph

Remove: Allows you to remove any graph that you created via the **New** command

Properties: Opens a dialog box with options for changing the Title, Type, Appearance, and Color of the graphs.



Bus Utilization Buttons

The Bus Utilization window buttons allow you to reformat the display and export data.

Button	Function
	Save. Saves Bus Utilization data to a bitmap file (***.bmp**).
	Email. Opens an email and attaches a bitmap file of the Bus Utilization data.
	Print. Prints the Bus Utilization data.
	Full Screen. Maximizes the Bus Utilization window.
	View Settings. Opens a sub-menu with the following choices: • Orient Horizontally • Tile Vertically • Show Markers • Show Plumbline • Status >> Bar Tool tips None • Grid Lines >> Both Axes X Axis Y Axis No Grid • Grid on Top • Fonts & Colors
	Horizontal zoom in
	Horizontal zoom out
	Vertical zoom in

Vertical zoom out

Click and Drag zoom. Click and drag to zoom in on a part of the graph.

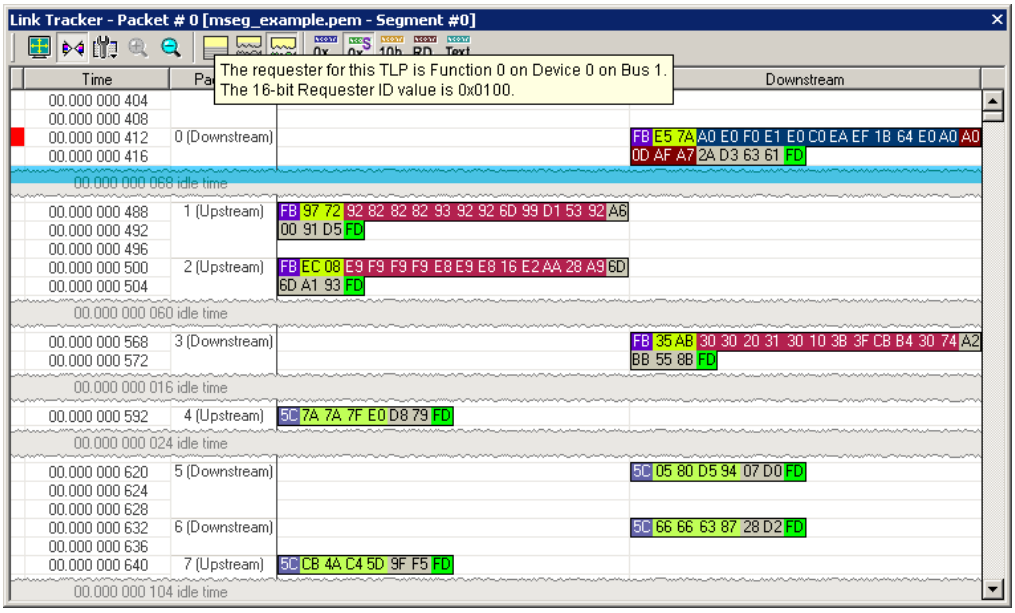
Select Range. Displays a dialog box for selecting a packet range.

Synchronize Graph Areas. If two or more graphs are displayed, this button synchronizes the graphs to one another. Once synchronized, the positioning slider of one graph moves the other graphs.

Graph Areas. Provides options for creating and displaying additional graphs of data lengths, packet lengths, and percentage of bus used.

9.5 Link Tracker

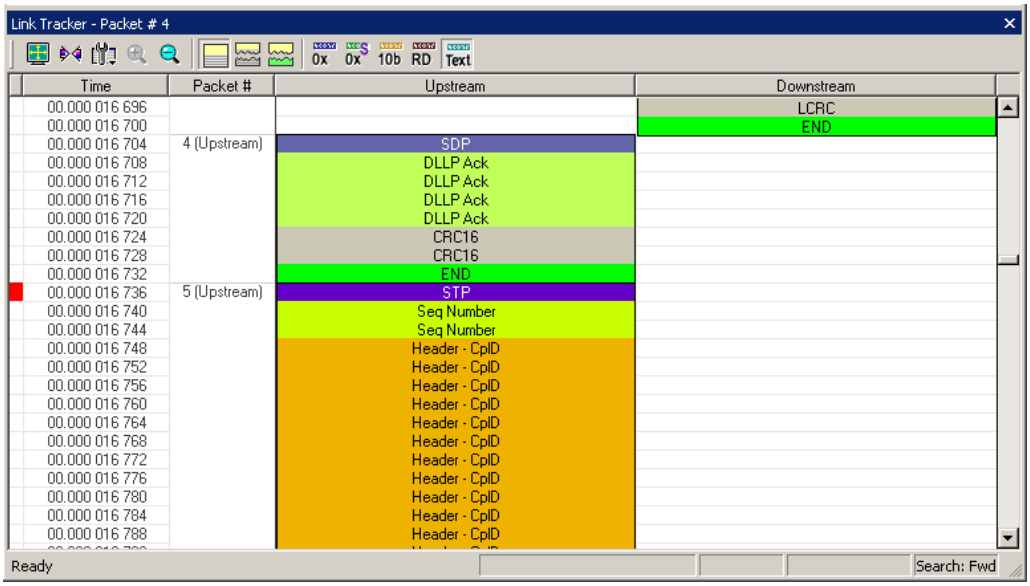
The Link Tracker window displays a detailed chronological view of events. Events are shown on a channel-by-channel basis in columns within the window.



Each time slot in the vertical axis represents the minimum time that a DWORD requires to traverse the bus.

Toolbar: Presents buttons for changing the format of the Link Tracker window.

Main Display Area: Displays traffic chronologically as it occurred in the recording. The window divides into columns: the first column shows time and traffic is shown on a channel-by-channel basis in the columns on the right.



Using the Link Tracker Window

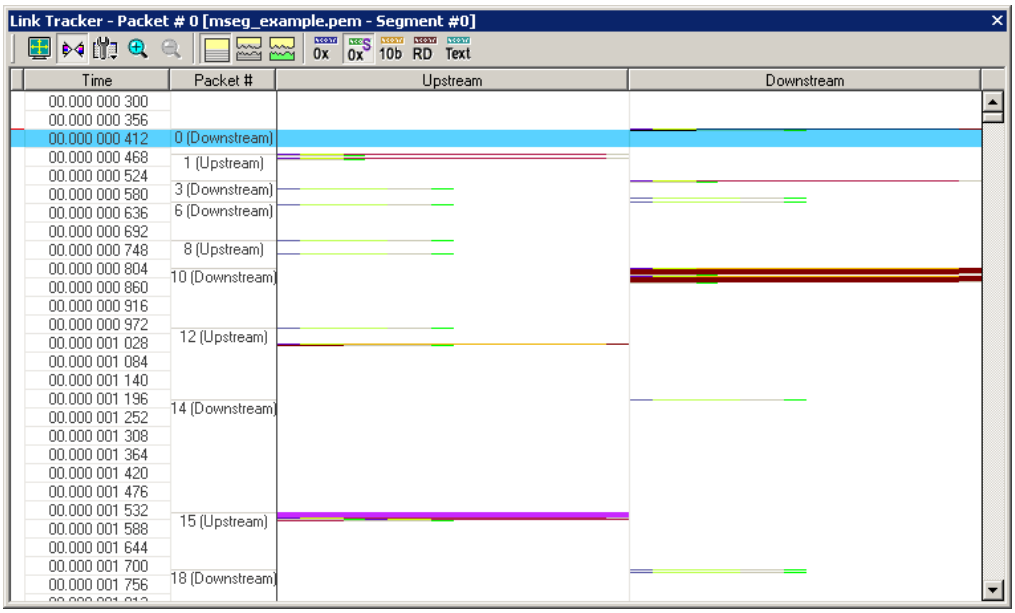
The Link Tracker window can be reformatted in several ways.

Zooming In and Out

Zooming out can give you a quick, high-level view of a CATC Trace. A fully zoomed out CATC Trace only shows columns and colored lines. Using the colors, you can see what types of traffic run through the CATC Trace.

Further information can be obtained on any point of interest in the CATC Trace by positioning your mouse pointer over it. Tool tips provide detailed description of events.

Note: When fully zoomed out, the smallest graphical unit is the DWORD, represented by a single line. Zooming out makes the CATC Trace appear smaller and increases the time scale in the first column.



Collapsing Idle Time, Enabling Tool tips, and Resetting Column Widths

Click the **View Options** button to open a menu with options for formatting the display. Three options are presented:

Collapsible Idle Time: Opens a dialog box for setting the Idle time value. Setting a value tells the Analyzer when to collapse Idle times and display them as grayed out strips within the Bus View window.

Tooltip Display: Opens a menu with options for adding content to Tooltips. Tooltips display when you position the mouse pointer over an item in the Bus View window. The options are:

- Tooltips Display Values
- Tooltips Display Scrambled Values
- Tooltips Display 10-bit Codes
- Tooltips Display Symbols

Time Format: Seconds or Clock

Reset Column Widths: This option resets column widths to their defaults and enables columns to resize themselves automatically any time the application window is resized. Normally, columns automatically resize themselves if the application window is made larger or smaller. However, if you manually resize any columns in the Bus View window, column widths become static. Thereafter, if you resize the application window, the Bus View columns do not adjust automatically. Reset Column Widths re-enables the automatic resizing capability.

Reset Columns Order: Return to default column sequence.

Docking and Undocking the Window

You can undock the Link Tracker window by double-clicking the blue title bar along the left side of the window. Once undocked, the window can be dragged anywhere in the application. To redock, double-click again on the title bar.

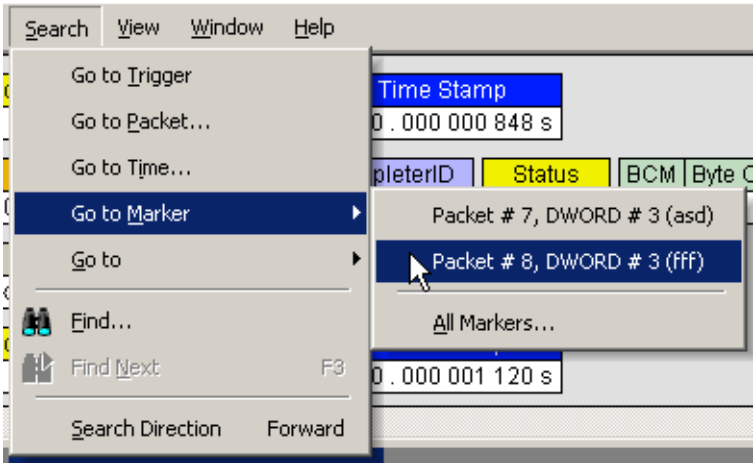
Setting Markers

Markers can be set on any event within the Link Tracker window.

To set a marker, right-click an event, then select **Set Marker** from the pop-up menu.

Once marked, you can navigate to events with the **Go to Marker** command in the Search menu.

Markers set in the Link Tracker window display the packet number and DWORD number. In contrast, markers set in the CATC Trace window just show the packet number.



Calculating Time between DWORDs

You can calculate time between DWORDs by clicking an event and then positioning your mouse pointer over a second event and reading the ensuing Tool tip.

Click the **time value** for the first event. Scroll down through the CATC Trace to the second event and position the mouse pointer above its time value. A Tool tip appears showing the time interval between the first and second events.

Hiding Traffic

You can hide Idles and other data from the Link Tracker window by clicking the **Hide** buttons on the toolbar.

Link Tracker Buttons

The Link Tracker window has a row of buttons for changing the format of the displayed data and for exporting data: The buttons have the following functions:

Full Screen. Expands the Link Tracker window to fill the entire screen.

View Options. Opens a menu with three options:

- **Collapsible Idle Time** (Collapse Idle Bigger Than **n** nanoseconds.
  Note: Does not affect Collapse Idle Plus.)
- **Tooltip Display** (Values, Scrambled Values, 10-bit Codes, Symbols)
- **Time Format** (Seconds, Clock)
- **Reset Columns Widths** (return to default widths)
- **Reset Columns Order** (return to default column sequence)

See “Using the Link Tracker Window” on page 71 for further details.

Synchronize Trace View. Synchronizes the Trace View and Link Tracker windows so that a move in one window repositions the other.
Because of the differences in scale and logic between the Link Tracker and Trace view window, scrolling produces different effects depending on which window is being scrolled.
Scrolling in the CATC Trace window causes the Link Tracker window to rapidly jump from event to event. Long periods of idle time are thus skipped.
Scrolling in the Link Tracker window, in contrast, produces modest movements within the CATC Trace window.
Scrolling in the Link Tracker window causes the CATC Trace window to pause until the beginning of a packet is displayed. At that point, the CATC Trace window repositions itself. While scrolling long Idle periods or through the contents of a packet, the CATC Trace window does not move.

Zoom In

Zoom Out

Continuous Time Scale. No collapsing.

Collapse Idle. Do not show some periods of Link being idle.

Collapse Idle Plus. Do not show periods of Link being idle.

Show Values

Show Scrambled Values

Show 10b Codes

Show Symbols

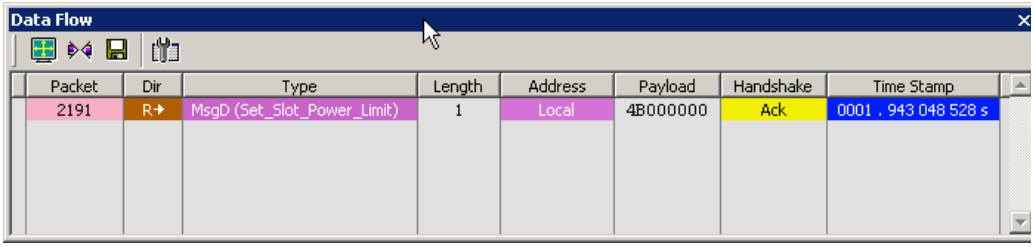
Show Text

9.6 Data Flow Window

The Data Flow window shows marker, packet, direction, type, length, address, payload, handshake, and timestamp information.

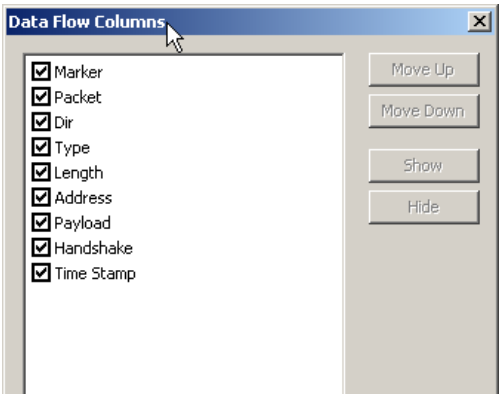
To obtain the Data Flow window, select **Report > Data Flow**

or click the Data Flow toolbar icon.



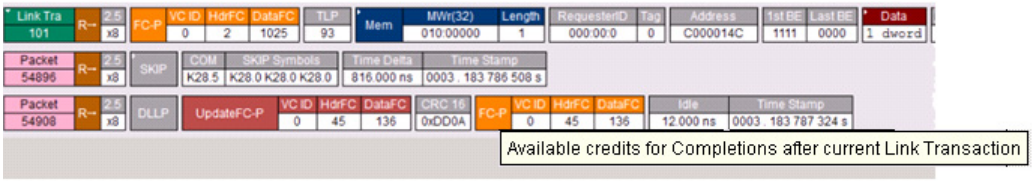
The toolbar allows you to:

- Expand the window to full screen or Collapse to a smaller window.
- Synchronize.
- Save.
- Select Data Flow columns to display and their widths:
  - Marker
  - Packet
  - Direction
  - Type
  - Length
  - Address
  - Payload
  - Handshake
  - Time Stamp



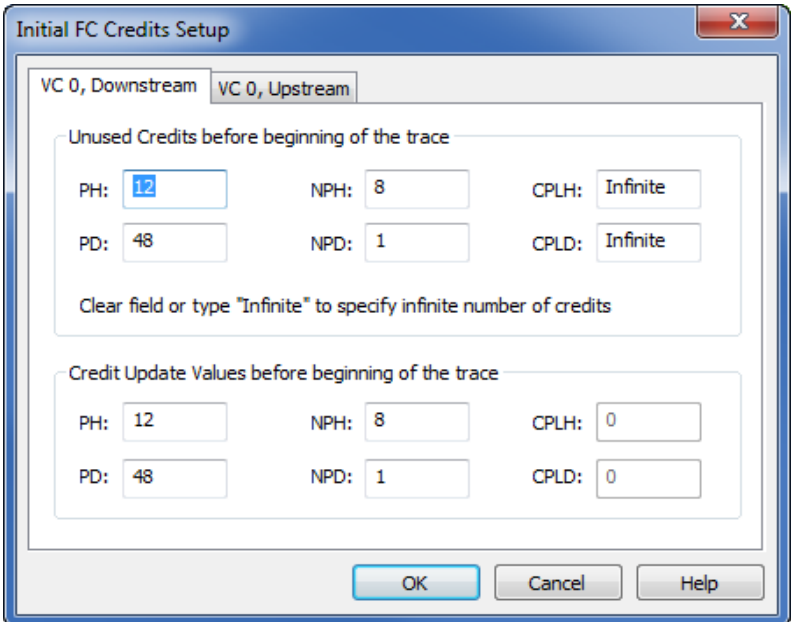
9.7 Flow Control Tracking

The Flow Control View mode highlights portions of the packets that affect flow control and displays flow control values. Flow control values shown at the beginning of Link Transaction display the credit values that were available prior to TLP transmission. Flow control values shown at the end of the Link Transaction display the credit values that were available after TLP was transmitted. Hover the mouse over the field to display tool-tips. Refer to the following screen capture.



If the trace includes Flow Control initialization, PCIe Protocol Suite detects the amount of available credits based on the values advertised in InitFC packets. If the InitFC packets are not in the trace, the amount of available credits can be set using the FC Credit Setup dialog (see the following screen capture).

For each virtual channel that is present in the trace you need to specify the amount of available credits before the beginning of the trace. You can also specify the values of credit fields for UpdateFC packets before the beginning of the trace. If the values of the UpdateFC credit fields are different than the values in the first UpdateFC packet, Flow Control tracking view will show that the first UpdateFC packet is releasing appropriate amount of credits. By default, PCIe Protocol Suite sets these values to match the first UpdateFC packets in the trace. The following screen capture shows the Flow Control Setup dialog.

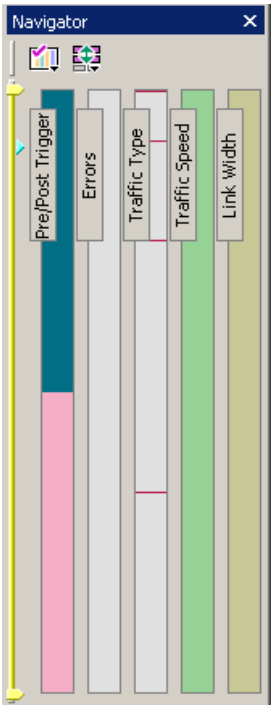


9.8 Using the CATC Trace Navigator

The CATC Trace Navigator is a tool for navigating within the CATC Trace. It allows you to view the location of errors and triggers in a CATC Trace and to narrow the range of traffic on display. It also allows you to quickly jump to any point in the CATC Trace.

Displaying the Navigator

Click in the toolbar to display the Navigator. The Navigator appears on the right side of the Main window. It has a two-button toolbar and a vertical slider bar. It also has colored panes for navigating the CATC Trace in different ways. You set which panes are displayed through Navigator pop-up menus.



Navigator Toolbar

The Navigator toolbar lets you quickly set Navigator features. The toolbar has two buttons.

Navigator Ranges: This button brings up a pop-up menu that lets you reset the Navigator range. The range determines what packets are viewable in the CATC Trace display.

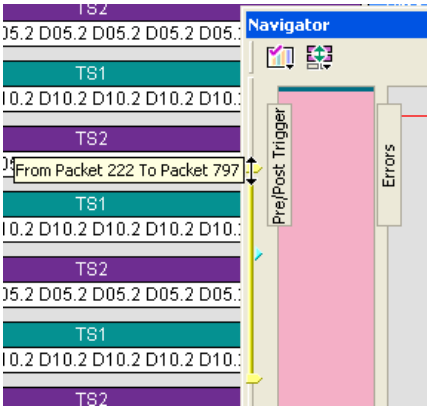
Navigator Panes: This button has two purposes: To select which Navigator panes appear and to bring up the Navigator legend. The legend determines how information is shown in the panes.

Navigator Ranges

You set the viewing range by dragging the **yellow range delimiters** along the slider.

To set the lowest packet viewable, drag the **top delimiter up**. As you do so, a tool tip appears to indicate the current range. Stop dragging when you reach the desired lowest packet.

To set the highest packet viewable, drag the **bottom delimiter down**. Stop when the tool tip indicates you are at the desired highest packet.



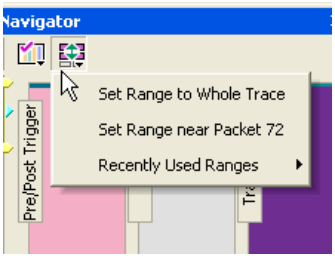
To Determine Current Position

In addition to the two range delimiters, the slider has a **blue current-position** indicator (see above). The current-position indicator shows where you are in the CATC Trace display with respect to the possible viewing range.

For example, suppose you set viewing range to packet 0 through packet 500 (the top range delimiter is at packet 0, and the bottom range delimiter is at packet 500). If you then move the current-position indicator on the slider to midway between the top and bottom delimiters, then packet 250 appears in the middle of the CATC Trace display.

To Reset Navigator Range

You can reset the Navigator range using the toolbar **Navigator Range** button. Press the button to bring up the Navigator Range drop-down menu.

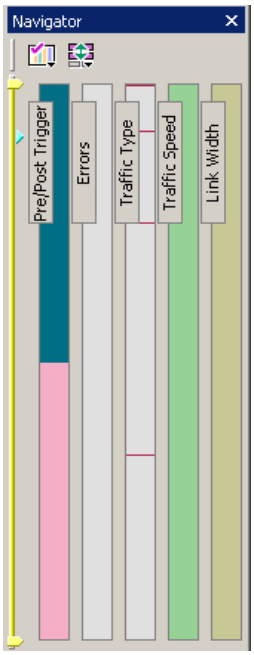


The menu has the following options:

- **Set Range to Whole Trace**: Allows you to reset the range to include the entire CATC Trace file contents. The top range delimiter is placed at the lowest packet number in the CATC Trace. The bottom range delimiter is placed at the highest packet number in the CATC Trace.
- **Set Range Near Packet xxx**: Allows you to collapse the range so that only the packets immediately above and below the xxx packet are displayed. The xxx packet is whatever packet is currently at the top in the CATC Trace display.
- **Recently Used Ranges**: Allows you to reset the range to any of a number of recently used (previously set) ranges.

Navigator Panes

You can display any combination of CATC Trace Navigator panes.



From left to right, the panes are: Pre/Post Trigger, Errors, Traffic Type, Traffic Speed, and Link Width. Each pane represents the entire CATC Trace with respect to different types of information. The top of each pane represents the start of the CATC Trace file, and the bottom represents the end of the CATC Trace file.

- **Pre/Post Trigger:** To view the trigger event in the CATC Trace and the relative size of pre-trigger and post-trigger portions of the CATC Trace. The two portions are set apart as different colors. The trigger event occurs at the point the two colors meet.
- **Errors:** To view any errors in the CATC Trace. A thin red line represents each error in the pane.
- **Traffic Type:** To view the types of packets that occur in the CATC Trace. A different color represents each packet type in the pane. The relative size of colored portions in the pane corresponds to the amounts of the various packet types in the CATC Trace. As described below, you can use the Navigator legend to change the types of packets that take precedence in the display.
- **Traffic Speed:** To view the speed that occurs in the CATC Trace.
- **Link Width:** To view the link width that occurs in the CATC Trace.

To Show/Hide Navigator Panes

You can show/hide any of the panes using pop-up menus accessible through left-click the **Navigator Panes** button or by right-click anywhere in any CATC Trace Navigator pane.

Navigator Slider

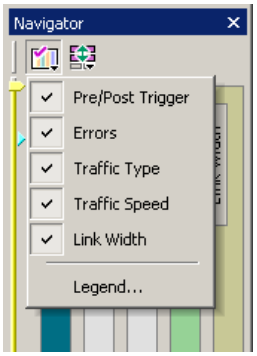
The Navigator slider appears at the left of Navigator panes. The slider has **yellow upper and lower range delimiters** and a **blue current-position** indicator.

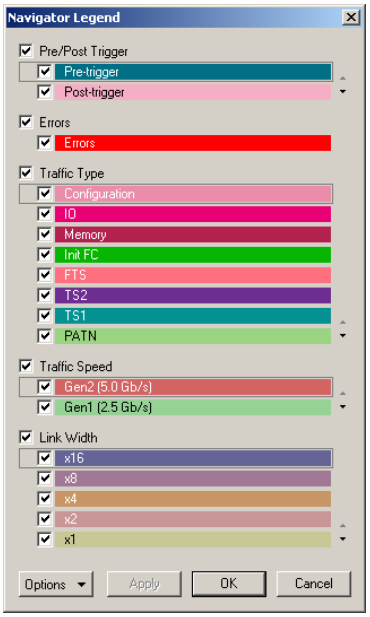
The Navigator slider lets you to set the range of packets viewable in the CATC Trace display. In other words, it sets scrolling range of the display. You can scroll the display up to the lowest packet number in the viewing range. You can scroll the display down to the highest packet number in the viewing range.

CATC Trace Navigator Legend

The Navigator legend lets you control the display of content in Navigator panes.

You bring up the legend through the Navigator Panes drop-down menu. Press the toolbar **Navigator Panes** button to access the menu. Select the **Legend** option to bring up the Navigator Legend dialog box.





The Navigator Legend dialog box has areas corresponding to each of the panes. Each area has check boxes that allow you to hide/display information in the pane. You can set the priority of information displayed in the panes using the up and down triangles on the right.

Using the Legend to Show/Hide Navigator Panes

To use the legend to show/hide an entire pane, use the **checkbox** next to the name of each pane in the legend.

In the case of the Pre/Post Trigger and Errors areas, the action of show/hide in the legend is identical to that provided by CATC Trace Navigator pop-up menus.

In the case of the Traffic Types pane, there is no equivalent show/hide available through the pop-up menus.

Using the Legend to Set the Priority of Information Display

You can use the legend to set the priority of information displayed in the Pre/Post Trigger Traffic Type panes. This is a two-step process.

Step 1 For a particular item in a pane, click the **column next to the checkbox** for the item. That labels the item as currently active.

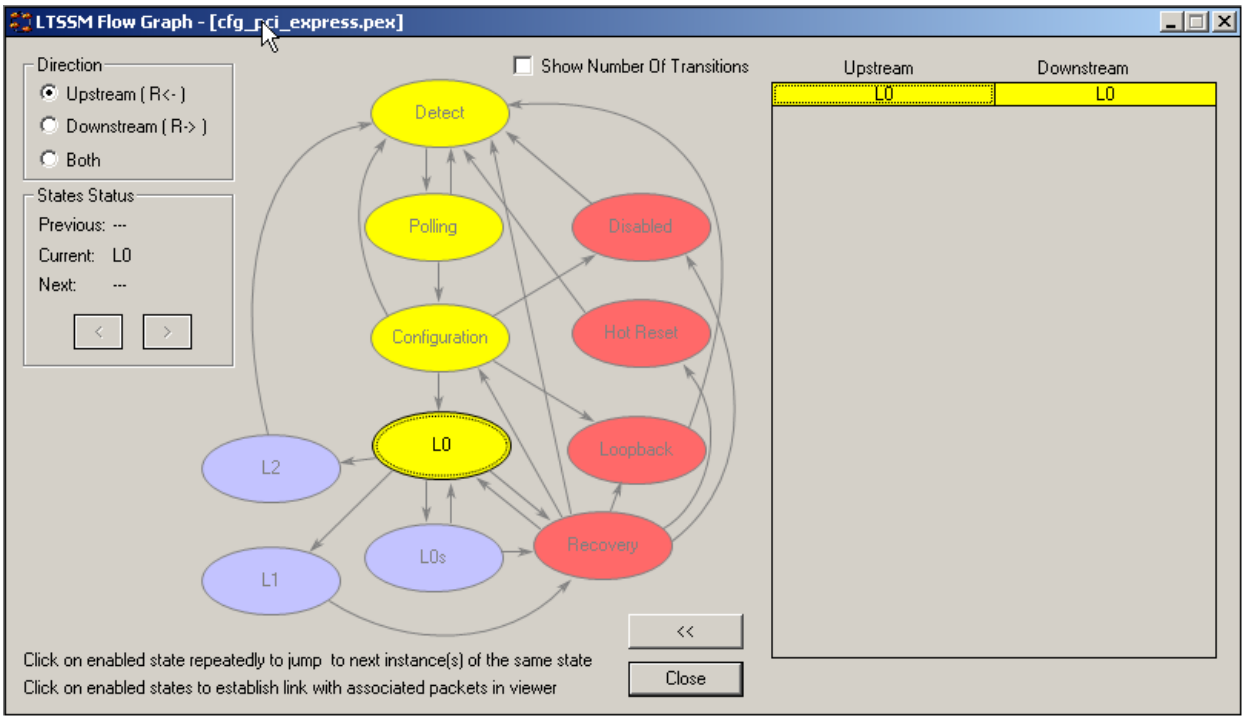
Step 2 Next, use the **up-down** at the lower-right of the area to move the item higher or lower in priority.

In the case of the Traffic Type pane, priority determines display priority of each packet type. For portions of the CATC Trace that are dominated by a particular packet type, this setting no effect: only the color corresponding to that packet type is displayed in that portion of the pane. Suppose, however, that part of the CATC Trace includes equal or near equal numbers of several types of packets. In that case, you can use the legend to select which among those types is represented in that portion of the Traffic Types pane. This allows you to view only packets of interest in crowded portions of the CATC Trace display.

9.9 LTSSM Flow Graph

The LTSSM Flow Graph shows link state transitions that the link goes through, as recorded in the CATC Trace file.

To obtain the LTSSM Flow Graph, select **View > LTSSM Flow Graph**.



You can display the following directions:

- **Upstream**
- **Downstream**
- **Both**

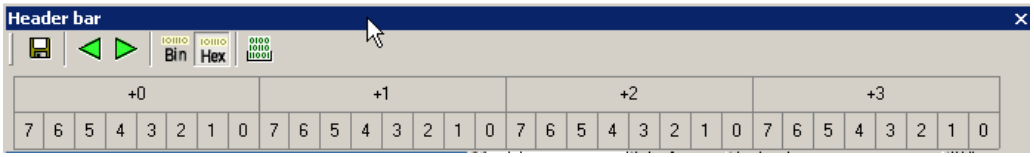
You can **Show Number of Transitions**.

9.10 Packet Header Bar

The Packet Header bar shows packet header information.

To obtain the Packet Header bar, select **Report > Packet Header**

or click the Packet Header toolbar icon.



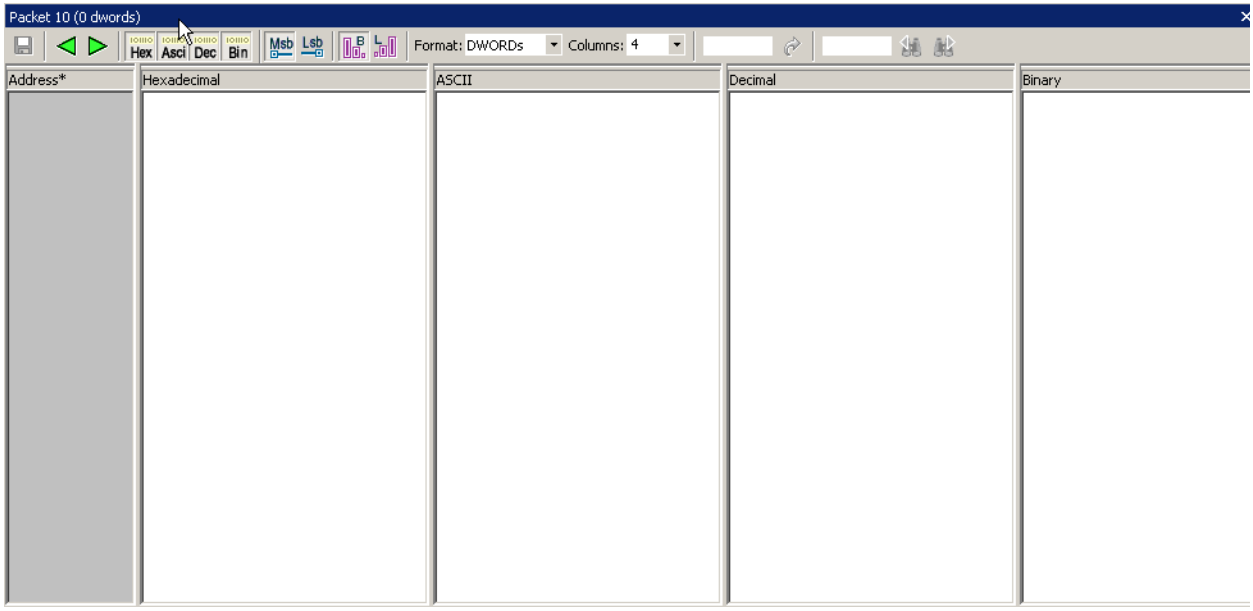
The toolbar allows you to Save, go to Previous or Next, display Hexadecimal or Binary, and show the Packet Data window.

9.11 Packet Data Window

The Packet Data window shows packet information.

To obtain the Packet Data window, select **Report > Packet Data**

or click the toolbar icon.



The toolbar allows you to Save; go to Previous or Next; display Hexadecimal, ASCII, Decimal, or Binary; use MSB Format or LSB Format; and use Big Endian or Little Endian.

Format and Columns allows you to enter the number of bytes, words, or dwords per line.

You can enter an Offset and scroll to it.

You can enter text and Search Previous or Search Next.

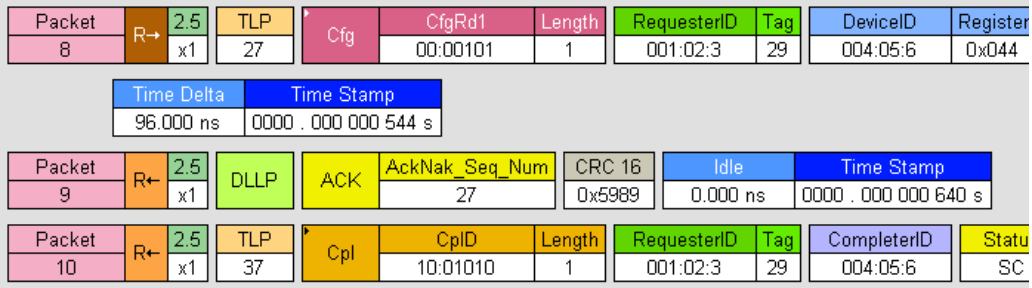
9.12 Configuration Space View

The Configuration Space View displays information about the Configuration Space state as of the current packet of the currently selected device. The view shows the Configuration Space Header and the PCI-compatible or PCI Express Capability Structures.

To display the Configuration Space View for a device at a packet:

Step 1 Open a CATC Trace, such as the sample file **cfg_pci_express.pex**.

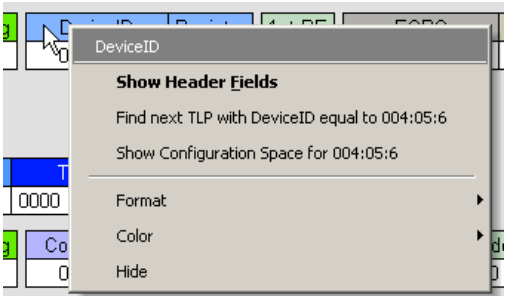
Step 2 Scroll to a packet with a Configuration header.



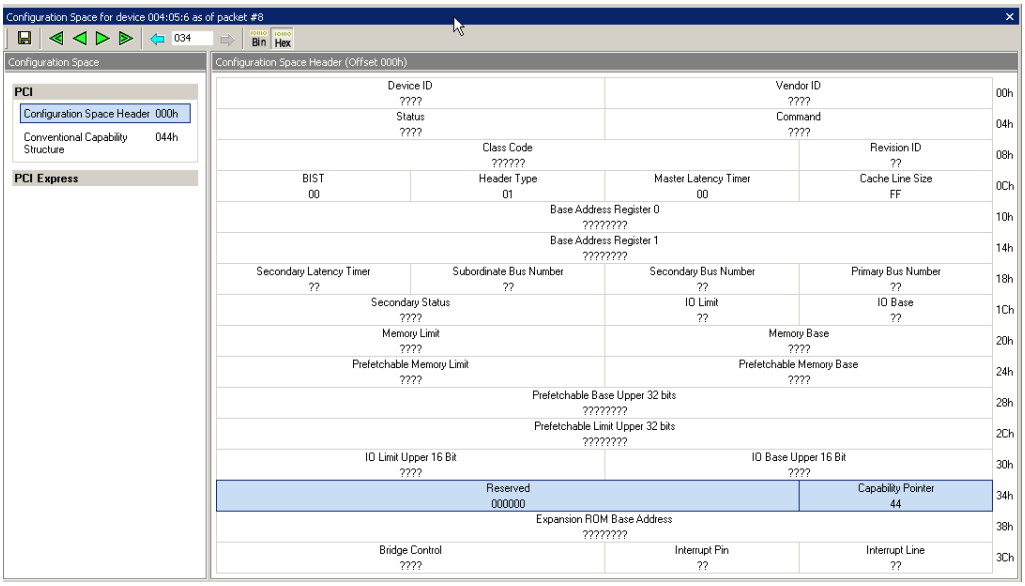
Step 3 Select **Report > Configuration Space > <device>** to display the Configuration Space View.

or

Click a **CompeterID** or **DeviceID** field. A pop-up menu opens.



Select **Show Configuration Space for xxxx** from the menu, where **xxxx** is the device number. The Configuration Space View opens.


Configuration Space for device 004:05:6 as of packet #8
034
Bin
Hex
Configuration Space
PCI
Configuration Space Header 000h
Conventional Capability Structure 044h
PCI Express
Configuration Space Header (Offset 000h)
Device ID ???? Vendor ID ???? 00h
Status ???? Command ???? 04h
Class Code ?????? Revision ID ?? 08h
BIST 00 Header Type 01 Master Latency Timer 00 Cache Line Size FF 0Ch
Base Address Register 0 ???????? 10h
Base Address Register 1 ???????? 14h
Secondary Latency Timer ?? Subordinate Bus Number ?? Secondary Bus Number ?? Primary Bus Number ?? 18h
Secondary Status ???? IO Limit ?? IO Base ?? 1Ch
Memory Limit ???? Memory Base ???? 20h
Prefetchable Memory Limit ???? Prefetchable Memory Base ???? 24h
Prefetchable Base Upper 32 bits ???????? 28h
Prefetchable Limit Upper 32 bits ???????? 2Ch
IO Limit Upper 16 Bit ???? IO Base Upper 16 Bit ???? 30h
Reserved 000000 Capability Pointer 44 34h
Expansion ROM Base Address ???????? 38h
Bridge Control ???? Interrupt Pin ?? Interrupt Line ?? 3Ch

On the left, the view displays the Configuration Space for the selected CompleterID or DeviceID at the current packet. You can select **Configuration Space Header** or a **Capability Structure.**

The right displays the decoded data of the selected Configuration Space Header or a Capability Structure, up to the current packet. (The decoding builds while navigating through the next packets.)

The Configuration Space View toolbar allows you to Save, go to First, go to Previous, go to Next, go to Last, go to Previous Access to Selected Configuration Space Register, go to Next Access to Selected Configuration Space Register, and display Hexadecimal or Binary.

Note: See Appendix A “Configuration Space Decoding” on page 104.

9.13 Using Unit Metrics

For every protocol unit at the Link or Split transaction level, SimPASS PE™ calculates and displays a set of metrics. Metrics are measurements of key operating parameters. You can use metrics to evaluate performance of traffic in the CATC Trace stream.

You can view metrics information in the CATC Trace display, the Traffic Summary window, and the Bus Utilization window.

SimPASS PE defines different metrics for Link and Split transactions.

Metrics Defined for Link Transactions

Number of Packets: The total number of packets that compose this Link transaction.

Payload: The number of data payload bytes this Link transaction transferred.

Response Time: The time it took to transmit this Link transaction on the PE link, from the beginning of the first packet in the transaction to the end of the last packet in the transaction.

Data Throughput: The payload divided by response time, expressed in megabytes per second.

Note: Usually, the Number of Packets metric for a link transaction is two (in case of explicit acknowledge) or one (in case of implicit acknowledge). However if Naks/link level retries are involved, this metric might be higher. As a result, the Number of Packets metric is useful in highlighting unusual link transactions.

Metrics Defined for Split Transactions

The following types of metrics currently are defined for Split transactions:

Number of Link Transactions: The total number of Link transactions that compose this Split transaction.

Payload: The number of payload bytes this Split transaction transferred.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction;

Data Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Latency Time: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Note: The Number Of Link Transactions metric for a Split Transaction usually is two for a Configuration or IO request. It can be bigger then two for a Memory Read request.

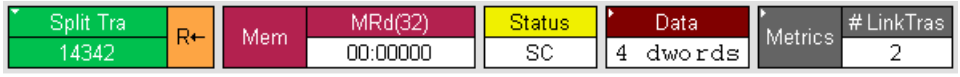
Show Metrics in the CATC Trace Display

In the CATC Trace view display of Link Transaction or Split Transaction levels, all metrics information applicable to a specific protocol unit is displayed in a Metrics header. The header is located close to the end of the unit, in front of the Time cell. You can expand and collapse the header to show or hide the metrics information.

Collapsed Metrics Header Display

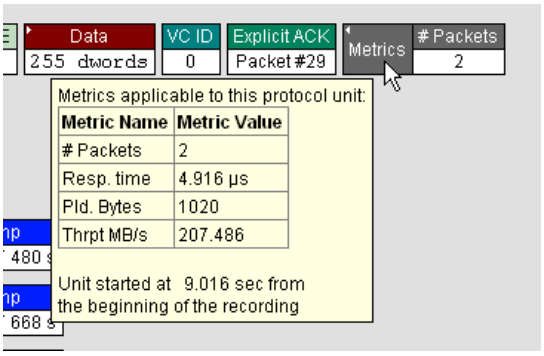
Following is a collapsed metrics display for a unit of Link Transaction. The collapsed header display shows only the metrics cell representing the Number of Packets.

Following is a collapsed metrics display for a unit of Split Transaction. The collapsed header display shows only the metrics cell representing Number of Link Transactions.



Metrics Tool Tip Display

In both CATC Trace level views, you can view the summary of all the unit metrics in the Metrics header tool tip. To view the tool tip, simply place the mouse cursor over the Metrics header. Following is the tool tip for a unit in the Link Transaction view.



Note: The tool tip also presents information for time passed from the start of the recording till the beginning of this Link or Split Transaction.

Expanded Metrics Header Display

When you expand the Metrics header, the display creates a separate cell for each applicable metric:

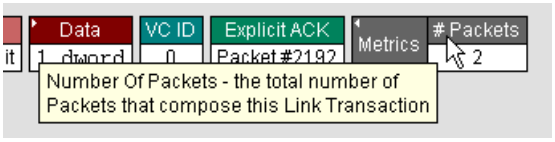
Following is the expanded Metric header for a unit in the Split Transaction view.

Metrics	# LinkTras	Resp. time	Latency	Thrpt MB/s	Pld. Bytes
	2	7.460 µs	6.736 µs	2.145	16

Following is the expanded Metric header for a unit in the Link Transaction view.

Metrics	# Packets	Resp. time	Pld. Bytes	Thrpt MB/s
	2	536.000 ns	64	119.403

Note: Each of the metric cells pops up a tool tip window with the explanation of what the metric means.

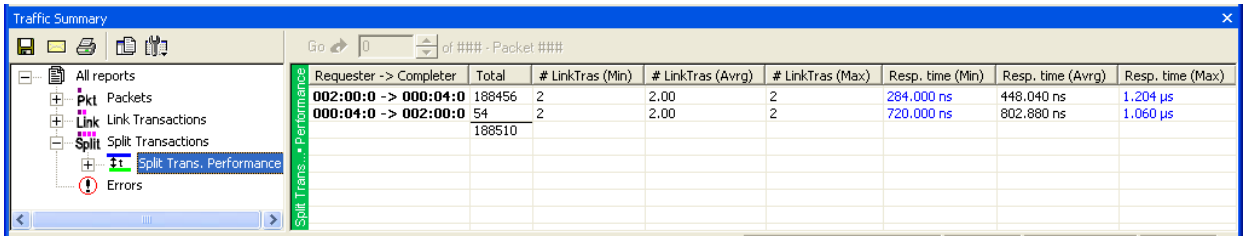


Show Metrics in the Traffic Summary Window

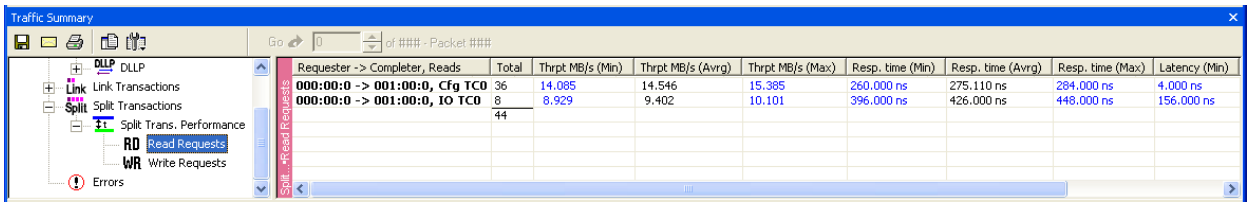
Some of the Traffic Summary reports at the Link and Split Transaction levels are based on metrics collected for the corresponding protocol units in the CATC Trace.

Reports at Split Transaction Level

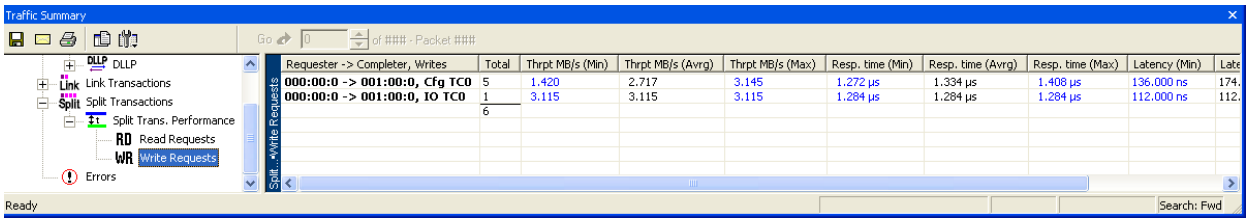
Split Transaction Performance: This report table groups the Split Transactions by Requester-Completer pair and displays Minimum/Average/Maximum data for Number Of Link Transactions and Response Time metrics.


Traffic Summary
All reports
Packets
Link Transactions
Split Transactions
Split Trans. Performance
Errors
Split Trans... - Performance
Requester -> Completer | Total | # LinkTras (Min) | # LinkTras (Avrg) | # LinkTras (Max) | Resp. time (Min) | Resp. time (Avrg) | Resp. time (Max)
002:00:0 -> 000:04:0 | 188456 | 2 | 2.00 | 2 | 284.000 ns | 448.040 ns | 1.204 µs
000:04:0 -> 002:00:0 | 54 | 2 | 2.00 | 2 | 720.000 ns | 802.880 ns | 1.060 µs
188510

Read Requests Performance: This report table includes only the Split Transactions that present Read Requests (Configuration, IO and Memory). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.


Traffic Summary
DLLP
Link Transactions
Split Transactions
Split Trans. Performance
RD Read Requests
WR Write Requests
Errors
Split...-Read Requests
Requester -> Completer, Reads | Total | Thrpt MB/s (Min) | Thrpt MB/s (Avrg) | Thrpt MB/s (Max) | Resp. time (Min) | Resp. time (Avrg) | Resp. time (Max) | Latency (Min)
000:00:0 -> 001:00:0, Cfg TC0 | 36 | 14.085 | 14.546 | 15.385 | 260.000 ns | 275.110 ns | 284.000 ns | 4.000 ns
000:00:0 -> 001:00:0, IO TC0 | 8 | 8.929 | 9.402 | 10.101 | 396.000 ns | 426.000 ns | 448.000 ns | 156.000 ns
44

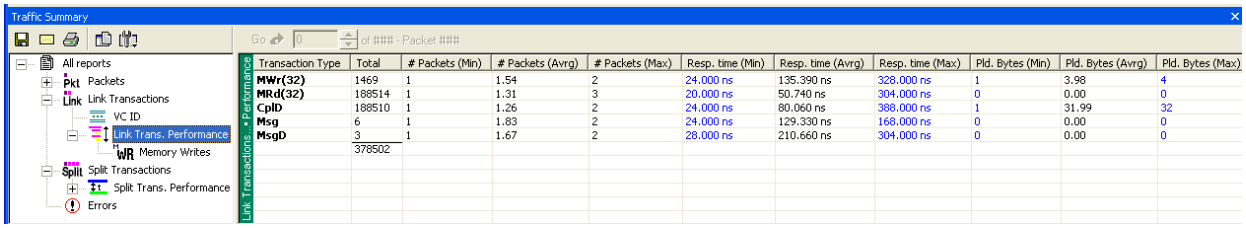
Write Requests Performance: This report table includes only the Split Transactions that present Write Requests (Configuration and IO). It groups them by the combination of Requester-Completer pair, request type, and Traffic Class and displays Minimum/Average/Maximum data for Throughput, Response Time, and Latency metrics.


Traffic Summary
DLLP
Link Transactions
Split Transactions
Split Trans. Performance
RD Read Requests
WR Write Requests
Errors
Split...-Write Requests
Requester -> Completer, Writes | Total | Thrpt MB/s (Min) | Thrpt MB/s (Avrg) | Thrpt MB/s (Max) | Resp. time (Min) | Resp. time (Avrg) | Resp. time (Max) | Latency (Min)
000:00:0 -> 001:00:0, Cfg TC0 | 5 | 1.420 | 2.717 | 3.145 | 1.272 µs | 1.334 µs | 1.408 µs | 136.000 ns
000:00:0 -> 001:00:0, IO TC0 | 1 | 3.115 | 3.115 | 3.115 | 1.284 µs | 1.284 µs | 1.284 µs | 112.000 ns
6
Ready
Search: Fwd

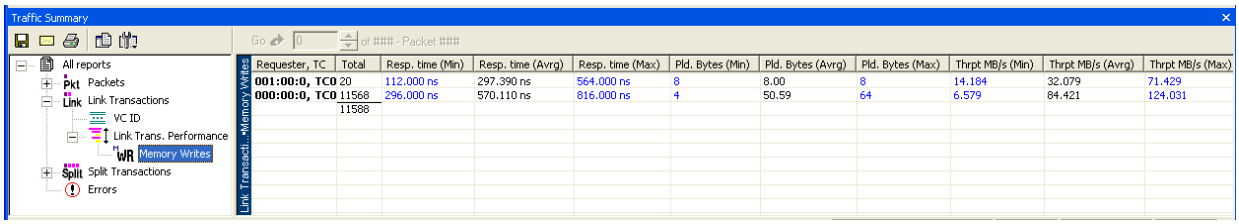
Reports at the Link Transaction Level

The following metric-based reports are displayed at the Link Transaction level:

Link Transaction Performance: This report table groups the Link Transactions by TLP Type and displays Minimum/Average/Maximum data for Number Of Packets, Response Time and Payload Bytes metrics.


Traffic Summary
All reports
Packets
Link Transactions
VC ID
Link Trans. Performance
Memory Writes
Split Transactions
Split Trans. Performance
Errors
Link Transactions - Performance
Transaction Type | Total | # Packets (Min) | # Packets (Avrg) | # Packets (Max) | Resp. time (Min) | Resp. time (Avrg) | Resp. time (Max) | Pld. Bytes (Min) | Pld. Bytes (Avrg) | Pld. Bytes (Max)
MWr(32) 1469 1 1.54 2 24.000 ns 135.390 ns 328.000 ns 1 3.98 4
MRd(32) 188514 1 1.31 3 20.000 ns 50.740 ns 304.000 ns 0 0.00 0
CplD 188510 1 1.26 2 24.000 ns 80.060 ns 388.000 ns 1 31.99 32
Msg 6 1 1.83 2 24.000 ns 129.330 ns 168.000 ns 0 0.00 0
MsgD 3 1 1.67 2 28.000 ns 210.660 ns 304.000 ns 0 0.00 0
378502

Memory Writes: This report table includes only the Link Transactions that present Memory Write Requests. Memory Writes are the only (posted) requests that don't get promoted to the Split transaction level, therefore their performance should be viewed at the Link transaction level. The table groups Memory Writes by the combination of Requester ID and Traffic Class and displays Minimum/Average/Maximum data for Response Time, Payload and Throughput metrics.


Traffic Summary
All reports
Packets
Link Transactions
VC ID
Link Trans. Performance
Memory Writes
Split Transactions
Errors
Link Transacti...Memory Writes
Requester, TC | Total | Resp. time (Min) | Resp. time (Avrg) | Resp. time (Max) | Pld. Bytes (Min) | Pld. Bytes (Avrg) | Pld. Bytes (Max) | Thrpt MB/s (Min) | Thrpt MB/s (Avrg) | Thrpt MB/s (Max)
001:00:0, TC0 20 112.000 ns 297.390 ns 564.000 ns 8 8.00 8 14.184 32.079 71.429
000:00:0, TC0 11568 296.000 ns 570.110 ns 816.000 ns 4 50.59 64 6.579 84.421 124.031
11588

Following features apply to all of the report tables described above for the Split Transaction and Link Transaction levels:

- Each report row for the defined tables contains the total number of units in this group for the CATC Trace (total number of units for Split Transaction performance, Read Requests performance, Memory Writes, and so on).
- In many cases, the Maximum and Minimum values in the report tables are navigable. By clicking table cells, you reposition the corresponding CATC Trace view to the Split or Link Transaction that has yielded this maximum or minimum value. This can help you to find specific units in the CATC Trace, such as transactions that produced spikes in Response Time or Throughput.

Show Metrics in the Bus Utilization Window

The Bus Utilization window provides graphs for packet-level information in the CATC Trace. The window also provides graphs for information on Split and Link Transaction levels, plotted over time. The graphs for Split and Link Transaction levels are based on metrics collected for the transactions throughout the CATC Trace.

The seven graphs related to Split and Transaction levels are:

1. Pending Requests at Split Transaction level.
2. Response Time at Split Transaction level.
3. Latency Time at Split Transaction level.
4. Throughput Per Transaction at Split Transaction level.
5. Response Time and Latency Time at Split Transaction level (combined graph).
6. Response Time at Link Transaction level, for Memory Writes only.
7. Throughput at Link Transaction level, for Memory Writes only.

The following is an example of Bus Utilization window display of graph numbers 1, 4, 5, 6 and 7:

Unit-Based Averaging

The Analyzer builds metric graphs using unit-based averaging (as opposed to time-based averaging). For the total duration of a certain request (or Memory Write transaction), the graph value is assumed equal to the corresponding metric for this request (transaction). If there are overlapping operations for a certain time period, then the value is calculated as an average of metric values for all the overlapped requests (transactions).

It is important to remember that the Analyzer uses unit-based averaging rather than time-based averaging. Time-based averaging can be misleading in some situations. For example, consider the Throughput Per Transaction graph. Sometimes, while many outstanding requests are in progress, latency (and response time) grows for each of the transactions, resulting in a lower throughput per transaction over time (which is reflected in the graph). This happens even though aggregated throughput across all the transactions is constant.

Bus Utilization Window Features

For the seven Split- and Transaction-level graphs listed, all Bus Utilization window features are available, such as zooming in/out, changing scale type, scrolling, context-sensitive status, and graph synchronization. See Bus Utilization and Bus Utilization Buttons for more on these features.

Note: Clicking a certain place within a graph area repositions the CATC Trace display at the Link or Split transaction level to the transaction that was in progress at that time.

Split Transaction Level Graphs

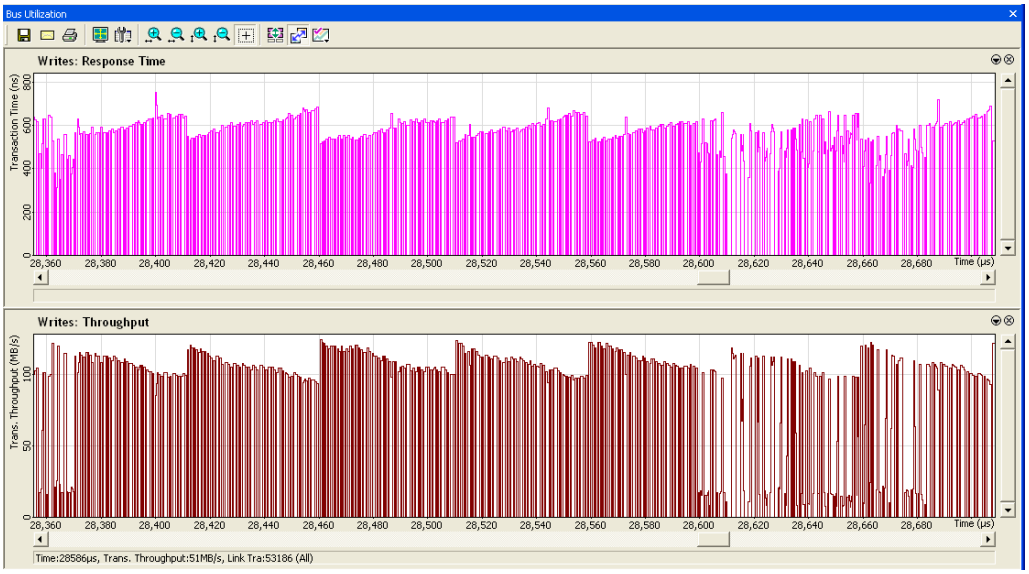
Transactions at the Split level combine all the non-posted requests with corresponding completions. This includes Configuration and IO Read and Write requests, as well as Memory Read requests.

The following shows the graphs for the Split level:

Note: The Pending Requests graph is not directly defined by metrics, but it is useful when considering metrics. The Pending Requests graph presents the unit-averaged number of requests that were pending (in progress) at any moment of time. It allows you to correlate the number of requests posted to a completer with other performance metrics.

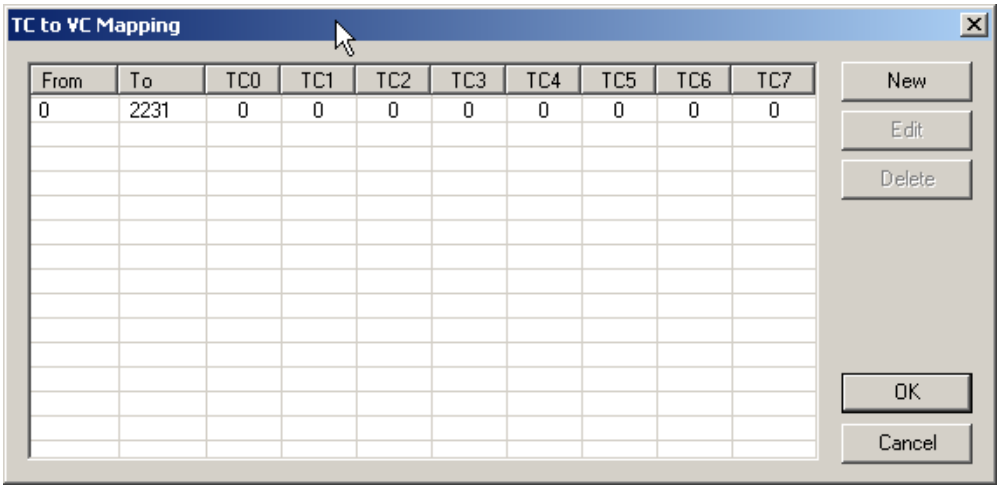
Link Transaction Level Graphs

Memory Writes are the only (posted) requests that do not get promoted to the Split transaction level. Therefore, Memory Write performance should be viewed at the Link Transaction level. That is the reason graphs at the Link level only present the Memory Write-related metrics and are titled **Writes: Response Time:** and **Writes: Throughput**.



9.14 TC to VC Mapping

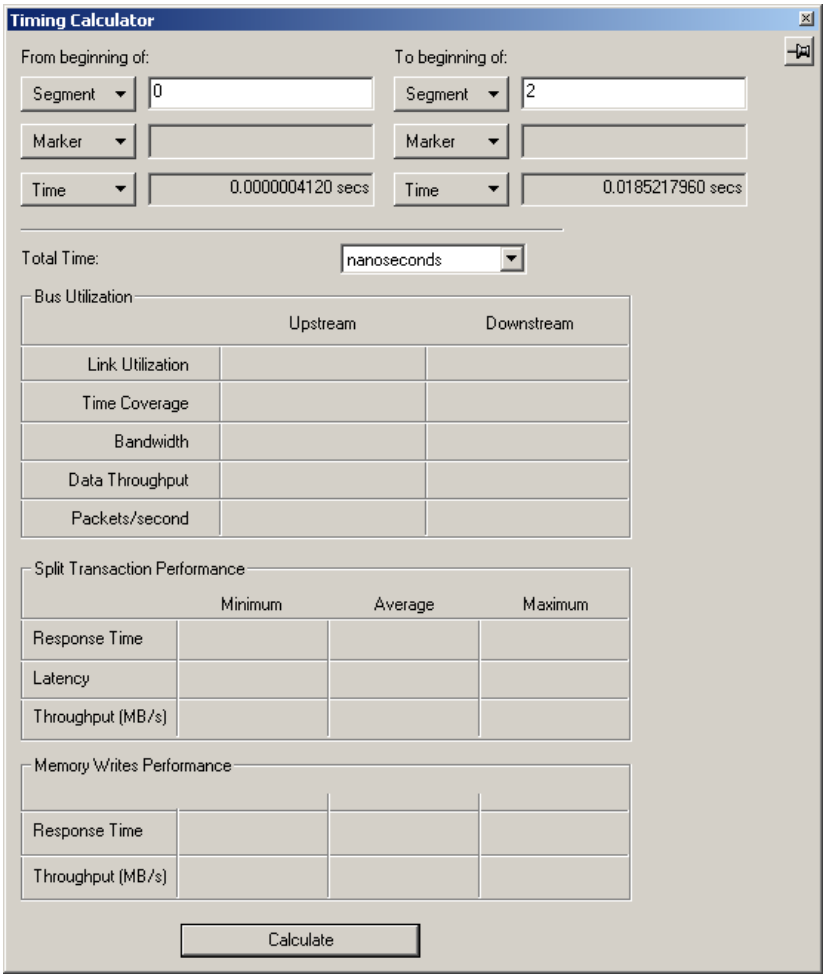
TC to VC Mapping displays how Traffic Classes are mapped to Virtual Channels (to simplify navigation) and how the CATC Trace display was changed (for example, in Split Transactions).



9.15 Timing and Bus Usage Calculations

The Timing and Bus Usage Calculator allows you to calculate time between packets.

Select **Reports > Timing Calculations** to obtain the Timing Calculator dialog box.



Total Time: Total time from beginning of the first unit to beginning of the second unit.

Bus Utilization

This portion of the Timing Calculator window gives values that are cumulative for all packets during the timing period. For example, throughput is combined throughput of all packets during the timing period.

Upstream is from endpoint devices to the root complex. Downstream is from the root complex to endpoint devices.

Link Utilization: Percentage of non-idle symbols in total number of symbols transferred.

Time Coverage: Percentage of non-idle symbol times in total number of symbol times. (Non-idle symbol time occurs when at least on one of the lanes there were non-idle symbols transferred.)

Bandwidth: Number of non-idle symbol bits transferred per second.

Data Throughput: Number of TLP payload bytes transferred per second.

Packets/second: Number of packets transferred per second.

Split Transaction Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Split transactions during the timing period. For example, minimum throughput is throughput of the Split transaction that passes the least amount of data. Maximum throughput is throughput of the Split transaction that passes the most amount of data. Average throughput is the average calculated for all Split transactions during the timing period.

Response Time: The time it took to transmit this Split transaction on the PE link, from the beginning of the first packet in the Split transaction to the end of the last packet in the Split transaction.

Latency: The time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split transaction.

Throughput: The transaction payload divided by response time, expressed in megabytes per second.

Memory Writes Performance

This portion of the Timing Calculator window gives minimum, maximum, and average values for all Memory Write transactions during the timing period. For example, minimum throughput is throughput of the Memory Write transaction that passes the least amount of data. Maximum throughput is throughput of the Memory Write transaction that passes the most amount of data. Average throughput is the average calculated for all Memory Write transactions during the timing period.

Response Time: The time it took to transmit this Memory Write on the PE link, from the beginning of the first packet in the Memory Write to the end of the last packet in the Memory Write.

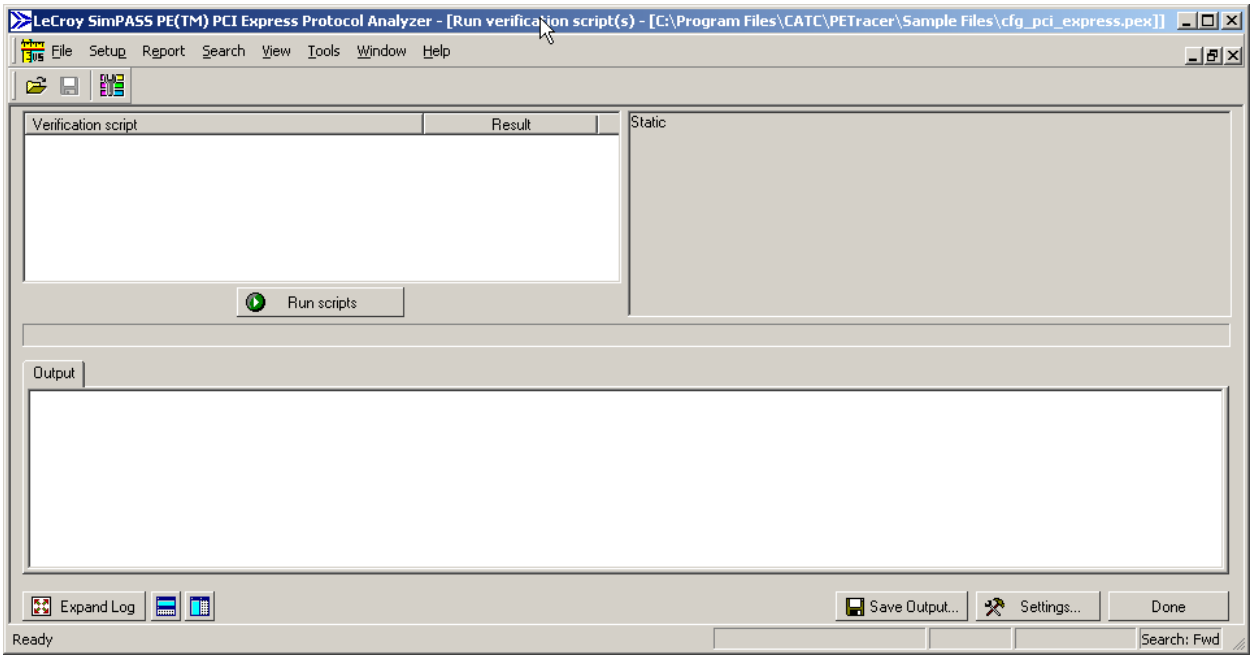
Throughput: The Memory Write payload divided by response time, expressed in megabytes per second.

9.16 Running Verification Scripts

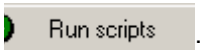
You can run verification scripts to check errors, link transactions, split transactions, metrics, ordered sets, replays, DLLPs, and TLPs.

To obtain the Verification Script dialog box, select **Tools > Run verification scripts**

or click the icon.

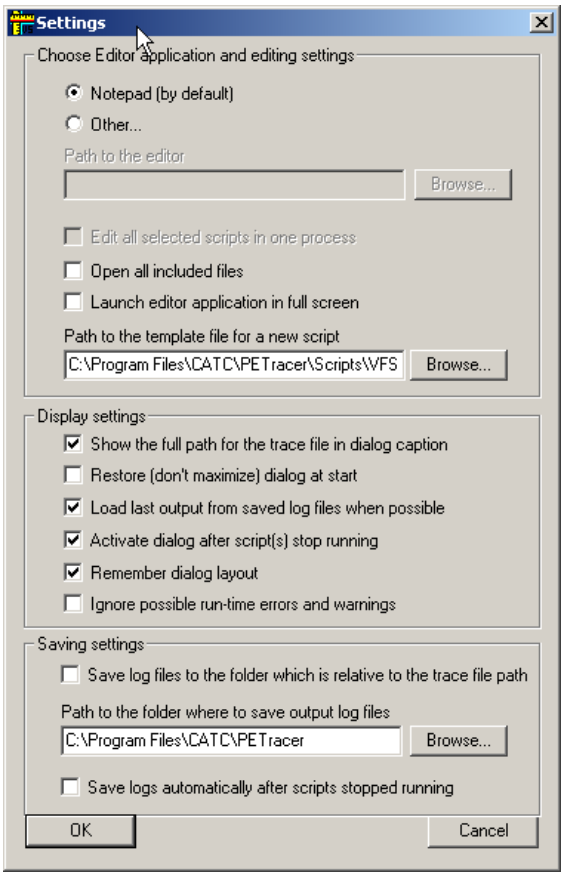


The available verification scripts are in the Verification script section.

To run a script, select it, then click the **Run Scripts** button  .

The results appear in the bottom window. You can expand or collapse this window. You find a view related to the CATC Trace and place this window under or to the right of it. You can Save the results.

Click the **Settings** button to display the Settings window.


Settings
Choose Editor application and editing settings
Notepad (by default)
Other...
Path to the editor
Browse...
Edit all selected scripts in one process
Open all included files
Launch editor application in full screen
Path to the template file for a new script
C:\Program Files\CATC\PETracer\Scripts\VFS
Browse...
Display settings
Show the full path for the trace file in dialog caption
Restore (don't maximize) dialog at start
Load last output from saved log files when possible
Activate dialog after script(s) stop running
Remember dialog layout
Ignore possible run-time errors and warnings
Saving settings
Save log files to the folder which is relative to the trace file path
Path to the folder where to save output log files
C:\Program Files\CATC\PETracer
Browse...
Save logs automatically after scripts stopped running
OK
Cancel

You can choose the editor, display settings, and saving settings.

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Appendix 10: Configuration Space Decoding

The decoded capability structures in the Configuration Space Viewer and Editor are based on programmed definitions in the SimPASS PE software and on Configuration Space Decode Scripts.

Configuration Space Decode Scripts are tools to define capability structures and instruct the Configuration Space Viewer or Editor how to decode them. These scripts are in the **\CfgSpaceScripts** sub-directory below the **\Scripts** directory in the application directory.

You can write Configuration Space Decode Scripts using the CATC Scripting Language (CSL). See the *LeCroy Analyzers File Based Decoding Manual* for reference.

PCI Express Configuration Space Decode Scripts have the file extension **.pecfgdec**.

10.1 Mandatory Definitions

Configuration Space Decode Scripts must set the following reserved variables.

- **CapabilityName**: Name of the capability structure
- **CapabilityID**: ID of the capability structure
- **ExtAddSpace**: Set to 1 if Extended Configuration Space.
  Otherwise, set to 0 for PCI.

10.2 Mandatory Module Functions

Modules are collections of functions and data dedicated to decoding a specific capability structure. Each module has one primary Configuration Space Decode Script file (extension **.pecfgdec**) and optionally has include files (**.inc**).

A module function is an entry-point into a decoding module. To help display a capability structure, the application calls a module function.

The Configuration Space Editor and Viewer support only the **DecodeRegister(offset)** and **GetSize( )** functions.

DecodeRegister(offset)

The application calls this function while decoding a specific DWORD offset of the specified CapabilityID. The offset is the decoding entry point, where the decoding path starts.

The Configuration Space Editor calls this function to determine how to decode the assigned configuration space. The **offset** parameter is the DWORD to decode.
An offset of 0 indicates bytes 00h-03h, an offset of 1 indicates bytes 04h-07h, and so on.

Note: The Configuration Space Editor can only decode one DWORD at a time.

GetSize()

This function returns the size of the capability structure specified by CapabilityID.

10.3 Configuration Register Types

The following reserved variables are defined global constants.

- CFGREG_UNDEFINED
- CFGREG_HWINIT
- CFGREG_RO
- CFGREG_RW
- CFGREG_RW1C
- CFGREG_ROS
- CFGREG_RWS
- CFGREG_RW1CS
- CFGREG_RSVDP
- CFGREG_RSVDZ

Note: These reserved variables match the Configuration Register Types of Table 7-2 in Section 7.4 of the PCI Express Base Specification, Rev. 2.1.

10.4 Primitives

Decoding uses the following primitives.

GetRegisterField(dword_offset, bit_offset, field_length)

This function returns a register field of length **field_length**, starting at bit position **bit_offset** in DWORD **dword_offset**.

- **dword_offset**: DWORD offset of the register field location
- **bit_offset**: Bit offset of the register field location
- **field_length**: Length of the register field

For example, **GetRegisterField(1, 9, 2);** means: Go to DWORD 1, bit offset 9, and returns 2 bits.

AddField(field_name, field_length, configuration_reg_type, tooltip, encoding_table = NULL)

This function adds a register field to the Capability View and returns a pointer to the field, for adding subfields.

- **field_name**: Name of the register field to display in the Capability View
- **field_length**: Length of the register field
- **configuration_reg_type**: Configuration register type of the register field.
  Note: If subfields are defined, their configuration register types override this setting for their specified bits.
- **tooltip**: Tooltip displayed for the register field in the Capability View
- **encoding_table**: Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View.

As examples:
AddField("PCI Express Extended Capability ID", 16, CFGREG_RO, "");
means: Add the field “PCI Express Extended Capability ID” with length 16 and cfg register type CFGREG_RO.

capability_reg = AddField("Capability Register", 32, CFGREG_RW, "");
means: Added the field “Capability Register” with length 32 and cfg register type CFGREG_RW and stored a pointer to this field in variable capability_reg, which can be used to add subfields to this field.

AddSubField(parent_field, subfield_name, subfield_length, configuration_reg_type, tooltip, encoding_table = NULL);

This function adds a subfield to a register field in the Capability View. Subfields are modifiable and visible in the Field View and appear in the tooltips of register fields.

- **parent_field**: Pointer to a register field in the Capability View
- **subfield_name**: Name of the subfield, displayed in the Field View
- **subfield_length**: Length of the subfield
- **configuration_reg_type**: Configuration register type of the subfield field.
  Note: This overrides the configuration_reg_type of the parent field.
- **tooltip**: Tooltip displayed for the subfield in the Capability View
- **encoding_table**: Optional. Displays encodings as lists for select values.
- For example, user input becomes a combo box for the field in the Field View
  .

For example,
AddSubField(capability_reg, "Mode Supported", 4, CFGREG_RO, "Indicates the Function modes,"), ModeEncodings);
means: Add the subfield “Mode Supported” to the parent field “capability_reg” with length 4, type CFGREG_RO, a tooltip in the Capability View, and a combo box displaying “mode encodings” for input in the Field View.

10.5 Helper File

ConfigSpaceCommon.inc include file contains useful functions for script decoding.

Appendix K: China Restriction of Hazardous Substances Table

The following tables are supplied in compliance with China's Restriction of Hazardous Substances (China RoHS) requirements:

	有毒有害物质和元素					
部件名称	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr^{6+})	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
PCBAs	X	O	X	X	X	X
机械硬件	O	O	X	O	O	O
金属片	O	O	X	O	O	O
塑料部件	O	O	O	O	X	X
电源	X	X	X	O	X	X
电源线	X	O	X	O	X	X
保护外壳(如有)	O	O	O	O	X	X
电缆组件(如有)	X	O	X	O	X	X
风扇(如有)	X	O	X	O	X	X
交流滤波器和熔丝组件(如有)	X	O	X	O	O	O
外部电源(如有)	X	X	X	O	X	X
探头(如有)	X	O	X	O	X	X
O: 表明该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求之下。						
X: 表明该有毒有害物质至少在该部件的某一均质材料中的含量超过 SJ/T11363-2006 标准规定的限量要求。						

EFUP (对环境友好的使用时间) 使用条件：参阅本手册“规范”部分规定的环境条件。

Part Name	Toxic or Hazardous Substances and Elements					
	Lead (Pb)	Mercury (Hg)	Cadmium (Cd)	Hexavalent Chromium (Cr^{6+})	Polybrominated Biphenyls (PBB)	Polybrominated Diphenyl Ethers (PBDE)
PCBAs	X	O	X	X	X	X
Mechanical Hardware	O	O	X	O	O	O
Sheet Metal	O	O	X	O	O	O
Plastic Parts	O	O	O	O	X	X
Power Supply	X	X	X	O	X	X
Power Cord	X	O	X	O	X	X
Protective Case (if present)	O	O	O	O	X	X
Cable Assemblies (if present)	X	O	X	O	X	X
Fans (if present)	X	O	X	O	X	X
AC Filter/Fuse Assy (if present)	X	O	X	O	O	O
Ext Power Supply (if present)	X	X	X	O	X	X
Probes (if present)	X	O	X	O	X	X
O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement specified in SJ/T11363-2006.						
X: Indicates that this toxic or hazardous substance contained in at least one of the homogenous materials used for this part is above the limit requirement specified in SJ/T11363-2006.						

EFUP (Environmental Friendly Use Period) Use Conditions: refer to the environmental conditions stated in the specifications section of this Manual.

How to Contact Teledyne LeCroy

Type of Service	Contact	
Call for technical support…	US and Canada: Worldwide:	1 (800) 909-7112 1 (408) 653-1260
Fax your questions…	Worldwide:	1 (408) 727-6622
Write a letter…	Teledyne LeCroy Protocol Solutions Group Customer Support 3385 Scott Blvd. Santa Clara, CA 95054-3115 USA	
Send e-mail…	psgsupport@teledynelecroy.com	
Visit Teledyne LeCroy's web site…	teledynelecroy.com/	

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